SAFETY REGULATIONS
FOR
ENGINEERING STAFF

Eighth Edition
1970

THE
BRITISH BROADCASTING CORPORATION
LONDON

SAFETY REGULATIONS FOR ENGINEERING STAFF

To..............................

Book No.......

This copy of the 8th edition of the Safety Regulations for Engineering Staff is for you and will be your personal property while you are on the staff of the BBC. This new edition comes into force immediately and supersedes the previous edition.

When amendments become necessary, revised sheets will be sent to you. You should insert these in the loose-leaf folder and make a note of them in the amendment sheet in the front of the folder.

Be sure you remember to sign and return the following page when you have received the Safety Regulations.

SAFETY REGULATIONS
FOR
ENGINEERING STAFF

AMENDMENT RECORD

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ESR-1			ESR-16		
ESR-2			ESR-17		
ESR-3			ESR-18		
ESR-4			ESR-19		
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SAFETY REGULATIONS FOR ENGINEERING STAFF

FOREWORD

This new edition of our Safety Regulations includes a number of changes that have been found necessary since the seventh edition was issued in 1967.

In a rapidly changing world, it is inevitable that equipment becomes more varied and more complicated —and sometimes introduces new hazards, which could be dangerous unless you know how to cope with them.

These Regulations have been produced to help you to avoid risks. I cannot stress too strongly the importance of observing them and of being prudent, alert and vigilant at all times.

The Regulations, comprehensive as they are, cannot possibly cover all conditions that will arise, but the habit of thinking cultivated by them will apply under all circumstances. Your life and health may depend on the care you take—and not only your own life and health but those of your colleagues.

You should therefore read these Safety Regulations right through very carefully and take particular care to read and re-read from time to time those parts that affect your own work.

When you change your job do not forget to look up the parts of the instructions appropriate to your new activity.

We have a good accident record. Let us make it even better.

J Redmond.

Director of Engineering, BBC

SAFETY RULES IN BRIEF

1. *Keep alert.* Carelessness or forgetfulness on your part may endanger not only your own life but the lives of your friends and colleagues. Watch your health; you are better able to keep alert if you come to work in a properly rested condition.
2. *Do not allow familiarity to lead to carelessness* in the handling of electrical apparatus. It is hardly necessary to remind you of the need for extreme care in dealing with high-voltage circuits, but ordinary domestic supplies at 240 volts are less fully protected and are responsible for a large proportion of all the fatal accidents caused by electrical equipment. Never treat such supplies as 'only mains voltage', and remember that equipment (including teleprinter switch-boards) operating on even lower voltages can be dangerous. Do not undertake maintenance work involving access to live conductors if it can be done with the equipment switched off and disconnected from the mains.
3. *Know what your responsibilities are* and do not carry out any dismantling, maintenance or testing work that goes beyond your competence. If you are in doubt about the interpretation of any of these regulations, or how best to protect yourself or any other staff for whom you would be responsible in any future emergency, consult your superior. Do not wait until the emergency arises.
4. *Read this book carefully.* It contains information on many dangers that you may not suspect, e.g., X-rays, materials that in certain circumstances may be dangerous, and radiation from VHF, UHF and SHF equipment. Have nothing to do

with potentially dangerous apparatus or materials unless you know exactly what you are doing.

5. *Do not take risks.* Never in any circumstances take chances with the safety devices provided for your protection, such as interlocks, in your zeal to clear a breakdown quickly. Do not override interlocks without special authority. On no account climb masts except in accordance with these regulations.
6. *Make sure you understand the working of protective devices,* the regulations about the isolation and earthing of circuits, and the use of fuses and earth connections.
7. *Find out the position of the isolators* for equipment on which people near to you are working, so that if they get into difficulties you will know where to cut off the supply. Your fellow-worker's life may depend on your ability to take rapid action.
8. *Never assume that conductors are dead* until you have taken the necessary steps to make quite certain that they are dead.
9. *Always remember that there may be more than one source of supply* to a particular piece of equipment, and that signal or r.f. voltages carried by or induced in conductors can also be dangerous.
10. *Report to your superior any abnormality* that might be a potential source of danger and any difficulties that may result from the use of apparatus in conditions other than those for which it was designed. Do not hesitate to put forward any potentially useful suggestions for improving safety.
11. *Pay attention to danger notices;* it is you they are intended to protect.
12. *Always follow the detailed local instructions* for the use of any apparatus and always carry out switch-

ing operations in the sequence laid down by such instructions.

13. *Do not ignore everyday risks.* Many accidents occur through very simple mistakes, such as leaving obstructions in passages, dropping tools from heights, failing to secure ladders or not making sure that equipment is properly fixed and safeguarded.
14. *Familiarize yourself with methods of first-aid and artificial respiration* and with the regulations for dealing with cases of electric shock. When you give first-aid, do it without a moment's delay; speed may be decisive in saving a life.
15. *Familiarize yourself with the Regulations on Fire Precautions.* This book tells you how to prevent fires and how to deal with them if they occur.
16. *Make sure* that all the equipment for which you are responsible is kept in good condition and is used with care.

CHAPTER 1

GENERAL REGULATIONS

1.1 Introduction

These Regulations are addressed to all members of Engineering Division except manual staff who, in the opinion of the Head of their Department, are unlikely to require an understanding of the risks associated with technical equipment.

All Engineering Staff must at all times observe these Regulations, so far as they apply to the types of equipment with which they are working.* It is the responsibility of Heads of Departments to ensure that no member of their staff is employed on work of any kind unless he is fully competent to undertake it and is aware of any risks that may be incurred.

While staff are undergoing training, and where part of the training requires work on live equipment, they may undertake such work only when

(a) they have had prior instruction about the risks they may incur and

(b) the Head of Department or Engineer-in-Charge responsible for them is satisfied that they have sufficient sense of responsibility to keep constantly mindful of these risks.

Each member of staff is responsible for ensuring his own safety, for observing any special directions given to him and for ensuring that any other staff assisting him in the work are competent to do so and are aware of any dangers that may exist (see also 3.1.1).

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*It is recognized, however, that it may not always be practicable to apply all the Regulations strictly to work on research, design, installation or testing; Heads of Departments may authorize certain staff to carry out such work in a manner that does not comply fully with these Regulations.

Members of the staff are expected to comply with all Regulations imposed by statute and with bye-laws issued by Local Authorities. Certain areas in BBC premises are now subject to the Factories Act 1961 or to the Factories Act (Northern Ireland) 1965 and all offices and ancillary areas (including canteens used mainly by persons employed in the offices) are subject to the Offices, Shops and Railways Premises Act of 1963. The requirements of these Acts have been taken into account in preparing this edition of the Safety Regulations for Engineering Staff. Instructions given by the competent Authorities under the Acts must be complied with, any difficulties being reported to the Head of Department or Superintendent Engineer. Those in charge of staff should be aware of the requirements of the Acts and of the Regulations issued under them and should act accordingly.

1.2 Local Instructions

In addition to the Regulations given in this book, it is necessary to issue from time to time local safety instructions to staff at certain premises, and to those working on mobile equipment. Such local instructions carry the same force as these Regulations, but do not over-ride them.

1.3 Protection of Staff from Danger

It is the responsibility of all engineers having staff under their control to take all reasonable steps to ensure that they are protected from danger. This applies not only to the dangers described in these Regulations but also to other hazards.

Those responsible for the direction of work involving special risks including those arising from working at abnormal heights or under abnormal conditions, from the use of dangerous materials (such as explosives or radio-active materials), from welding, from the use of lifting gear and from the examination, cleaning or repair of fuel tanks, must ascertain what precautions are necessary and must see that they are carried out. Reference should be made to official publications on these subjects, such as those mentioned under relevant headings in these Regulations.

Only staff who willingly accept the conditions presented to them are required to work at abnormal heights or under abnormal conditions.

1.4 Taking of Risks

Formal regulations cannot in themselves ensure the safety of personnel and property; the human element is all-important. Speed in the removal of faults on equipment is desirable, but taking risks in order to save time can lead to accidents, and **in no circumstances may life be endangered in order to reduce the period of breakdown.** Carelessness is the most dangerous of the problems introduced by the human element and senior engineers should constantly be on the watch for signs of carelessness in the staff under their control. Disciplinary action should be taken whenever it is required to check any tendency towards carelessness. All engineers having staff under their control should ensure as far as possible that all these staff are constantly alert to dangers inherent in the equipment with which their work is concerned and that only members of their staff fully competent to do so are allowed to carry out any technical operations where a mistake could lead to personal danger. No set of regulations can cover every eventuality and it is the responsibility of the Senior Engineering Representative on Duty (as defined below) to take all reasonable steps to ensure the safety of staff at all times.

It is now a legal requirement under the Factories Act 1961 that where any means or appliance for securing health or safety is provided for the use of any person working in a place to which this Act applies, he shall use the means or appliance. Further, no person employed in any place to which the Act applies shall wilfully and without reasonable cause do anything likely to endanger himself or others.

1.5 Conformity of Equipment with Regulations

It is the duty of those responsible for the design and installation of plant and equipment to ensure that installations carried out or supervised by them comply with these Regulations, as far as they are applicable, and with recognized standards of good engineering practice.

When equipment is supplied it must be of a type approved as safe by the appropriate specialist Department; when items of equipment are put into service or are under maintenance, the Senior Engineering Representative on Duty is responsible, except where otherwise stated, for ensuring that they are in a safe condition.

1.6 Definitions

Terms used in the Regulations are to be interpreted as follows:—

Supervising Engineer:

An engineer who is in permanent control of a group of Engineering Staff, whether designated as Engineer-in-Charge or otherwise.

Senior Engineering Representative on Duty:

A member of Engineering Division who, acting under an Engineer-in-Charge or Head of Department, is in control of a group of Engineering Staff for the period of a shift or for a particular task, whether in the nature of installation, testing, operation, repair, maintenance or other work. (There may be more than one such group at any one site.)

Engineer-in-Charge, House Services (Television):

An engineer, on Television Engineering Establishment, who is in permanent control of a group of Engineering Staff concerned with the maintenance of lighting (including studio lighting), heating, ventilation, heavy catering equipment and power supplies in London Television premises.

Engineer-in-Charge, House Services (Radio Broadcasting):

An engineer, on Radio Broadcasting Engineering Establishment, who is in permanent control of a group of Engineering Staff concerned with the maintenance of lighting, heating, ventilation, heavy catering equipment and power supplies in London Radio Broadcasting premises.

Specialist Department:

Any department in the Engineering Division of the BBC other than one of the Operations and Maintenance Departments.

Senior Specialist Engineer on Duty:

A member of a Specialist Department in the Engineering Division of the BBC who, acting under the Head of his Department, is in control of a group of Engineering Staff for a particular task, whether in the nature of installation, testing, operation, repair, maintenance or other work. (There may be more than one such group at any one site.)

Equipment:

This term includes all types of plant and apparatus.

Live:

Of any part carrying an electrical voltage, whether d.c., a.c. or r.f., in such condition that contact with it might cause dangerous electric shock, electrical burns, heavy short-circuit current or a combination of these.

> Note: The following definitions of voltage are based on the Electricity Regulations and on the I.E.E. Regulations for the Electrical Equipment of Buildings, and apply equally to d.c. and to a.c. (r.m.s.) except where otherwise stated. The voltage limits apply to the voltage between any two conductors or between any conductor and earth, whichever is the greater.

Extra-low Voltage:
Normally not exceeding 50 volts between conductors, and not exceeding 30 volts a.c. or 50 volts d.c. between any conductor and earth, where the electrical energy is used.

Low Voltage:
Normally exceeding extra-low voltage but not exceeding 250 volts, where the electrical energy is used.

Medium Voltage:
Normally exceeding 250 volts but not exceeding 650 volts, where the electrical energy is used.

High Voltage:
Normally exceeding 650 volts but not exceeding 3,000 volts, where the electrical energy is used.

Extra-high Voltage:
Normally exceeding 3,000 volts, where the electrical energy is used.

Very High Frequency (VHF):
Any frequency in the range 30-300 MHz.

Ultra-high Frequency (UHF):
Any frequency in the range 300-3,000 MHz.

Super-high Frequency (SHF):
Any frequency in the range 3,000-30,000 MHz.

1.7 Responsibility for Observance of Safety Regulations

1.7.1 When any equipment is working on normal routine or any work is being done on it by one of the Operations and Maintenance Departments, the Senior Engineering Representative on Duty of all the Operations and Maintenance Staff (including Regional and House Services Engineering Staff) engaged in the operation is responsible for the interpretation of the Safety Regulations and for their observance by the staff carrying out the operation, irrespective of any other persons who may be present at the time.

At any time when the Senior Engineering Representative on Duty finds it necessary to be absent, he must, before leaving, hand over to the senior member of engineering staff of his group, who will be responsible for ensuring that the directions of the Senior Engineering Representative on Duty are carried out and that any departures from those directions which become necessary in the course of the work conform to the Safety Regulations.

1.7.2 When members of a Specialist Department carry out work on equipment, the Senior Specialist Engineer on Duty is responsible for the safety of those doing the work and of the equipment on which they are working, and for any repercussions or abnormalities which the specialized work may cause on any other equipment on the station.

At any time when the Senior Specialist Engineer on Duty finds it necessary to be absent, he must, before leaving, hand over to the senior engineer present, who will be responsible for ensuring that the directions of the Senior Specialist Engineer on Duty are carried out, and that any departures from those directions which become necessary in the course of the work conform to the Safety Regulations.

1.7.3 When a Specialist Department carries out or supervises work on a station, the observance of the Safety Regulations on all equipment except that with which the Specialist Department is directly concerned is the responsibility of the local Engineer-in-Charge, there having been prior consultation to avoid dangers resulting from unilateral action.

1.7.4 When Contractors' employees are working on BBC buildings, masts or equipment, it is the responsibility of

(a) the BBC Engineer-in-Charge, or his authorized deputy or, in London, the Engineer-in-Charge, House Services (Television) or the Engineer-in-Charge, House Services (Radio Broadcasting) or

(b) if the work is done under the direct supervision of a BBC Specialist Department, the senior member of that department on duty,

to ensure that no action is taken by BBC staff which is likely to endanger the safety of such employees, or vice versa. (See also Regulations under 1.9.)

1.7.5 No person may have access to any equipment for which the BBC is responsible, while it is undergoing installation, testing or maintenance, without the permission of the Senior Engineering Representative or Specialist Engineer mentioned in Regulations 1.7.1 or 1.7.2 as the case may be.

1.8 Non-Engineering Staff

1.8.1 Engineers-in-Charge must ensure that unauthorized staff do not operate any technical plant or equipment. Where non-engineering staff are authorized to operate technical equipment, the responsibility of the Engineer-in-Charge is confined to ensuring that the equipment is in working order when handed over, and is periodically inspected. He has no control over the way it is operated by the non-engineering staff, but should be prepared to advise on the correct method of operation; in the event of such advice being disregarded, he should refer the matter to the appropriate quarter. (See also Regulation 2.4.7(j).)

1.8.2 Engineers-in-Charge must ensure that visitors and unauthorized staff do not enter any room, cubicle or enclosure for which they are operationally responsible, without permission. When permission is given, such persons must be accompanied by a member of the Engineering Staff or by a BBC official authorized to enter the area, who will be held responsible for their safety. Engineering and non-engineering staff in certain categories, including firemen and cleaners, are authorized to enter such areas when they require to do so in the course of their duty.

1.9 Contractors' Employees and Assistance to Contractors (see also Regulations 1.7.4, 2.8.1(q))

1.9.1 Contractors' employees are forbidden to carry out work in any technical area in which live BBC equipment (i.e., equipment already taken over by the BBC) is situated except with the specific permission of the Engineer-in-Charge or his authorized deputy.

An exception to this Regulation may be made for employees of the Electricity Supply Authority or the G.P.O., who may be permitted to work on their equipment provided they are fully authorized by their employers.

1.9.2 Contractors' employees may be permitted to do essential work in close proximity to live BBC equipment only if all the following conditions obtain:—

(a) adequate precautions have been taken to protect personnel, special attention being paid to holes or open manholes at ground level,

(b) permission has been obtained from the Engineer-in-Charge or the representative of the Head of the Department responsible for supervising the work, or both, if appropriate (See Regulations 1.7),

(c) attention has been specifically drawn to any special danger and

(d) when considered necessary, a responsible member of the BBC department supervising the work is available to be present throughout.

Delegation of supervisory responsibility to a member of another department is forbidden except with the approval of the Head or Superintendent Engineer of that department.

1.9.3 Contractors' employees must not, in general, be permitted to use electrically operated tools and appliances owned by the BBC (see section 3.1.2(c)).

1.9.4 Contractors' employees must not be allowed to operate cranes or hoists forming part of BBC equipment without the permission of the BBC Senior Engineer on Duty. (See section 3.1.2(d).)

1.9.5 Requests may be received from contractors on site for BBC staff to assist in carrying out work on which the contractors are engaged. Such requests may involve legal problems in relation to liability for accidents; they must not be complied with without specific authority from the Superintendent Engineer or Head of Department concerned.

1.10 **Danger Notices** (see Section 3.1.3)

1.10.1 Terminals at voltages other than extra-low (except in conditions covered by the red/green light system described in 2.7.2(b) and 3.8.2) must be enclosed, and the covers must either be labelled 'DANGER LIVE TERMINALS ENCLOSED' or carry a red flash where such covers may be removed without the use of tools. This applies also to Television and Sound Broadcast Receivers when the Corporation is responsible for maintenance (see Regulations under 2.4.11).

Terminals carrying ringing current supplies in the range 17-25 Hz are exempt from this Regulation if they comply with the note at the beginning of Regulation 2.4.1(e).

All covers, however, whatever the voltage exposed, must be replaced after any work needing their removal has been completed.

Warning: Take care to prevent extra-low voltage circuits from coming into contact with circuits carrying higher voltages.

1.10.2 Covers of all isolating switches having terminals at such voltages must be labelled 'DANGER LIVE TERMINALS ENCLOSED' or carry a red flash even when the removal of covers requires the use of tools. The actual voltage, and whether a.c. or d.c., should be stated.

1.10.3 Where the red flash is used, there must be displayed near the apparatus so marked a prominent notice explaining the significance of the symbol.

1.10.4 Equipment undergoing modification or testing at transmitting stations must be labelled 'CAUTION. THIS PLANT IS UNDER TEST. PLANT ACCEPTANCE AND SAFETY PRECAUTIONS PROCEDURE IS INCOMPLETE' where:

(a) the prescribed procedure for acceptance and safety precautions has not been completed or has been suspended, or

(b) the plant is under the control of a Specialist Engineer, or others, for the purpose of alteration, and the work is such as to require subsequent acceptance of the plant.

In addition, notices must be posted prohibiting access to the plant without permission from the person in charge of the tests or of the operation of the plant. Such notices must be posted on all access doors or gates. Where plant is accessible it must be roped off and notices affixed to the barrier. Such notices must be worded 'ENTRY PROHIBITED WITHOUT PERMISSION FROM MR...'. Such caution notices must not be removed until the Acceptance Form is signed.

Equipment undergoing installation, modification or testing at studio premises must be labelled 'CAUTION. THIS PLANT IS UNDER TEST AND MAY BE DANGEROUS'.

1.10.5 When any isolator or switch is used to interrupt the supply to equipment undergoing maintenance work, a danger notice must be affixed to the isolator or switch.

1.10.6 The Engineer-in-Charge must periodically inspect all danger notices, whether permanent or temporary, to ensure that they are clearly legible and securely fixed.

1.10.7 In order to maintain respect for danger notices, all those which are temporary must be removed as soon as possible after completion of the work for which they were provided.

1.11 Purchased, Hired or Borrowed Equipment

Particular care must be taken with all equipment in this category. It is the duty of the Senior Engineering Representative on Duty to satisfy himself that such equipment conforms to the standards of safety required of BBC equipment, referring to the appropriate engineering department as necessary.

CHAPTER 2

CLASSIFIED REGULATIONS

2.1 Fire Precautions (see Section 3.2)

2.1.1 General

Fire can take hold and spread with startling speed, and everyone must therefore concern himself in advance with the dangerous situations to which an outbreak could give rise.

He must get to know in advance what are the local arrangements and instructions in case of fire; for example, where the fire-fighting appliances are kept and how to use them, and where the emergency exits and escape routes are.

Regulations applying to BBC staff generally must be observed as well as the following Regulations applying particularly to engineering installations.

Heads of Departments and Engineers-in-Charge responsible for premises classified as Engineering Premises must ensure that their staff know what to do in case of fire and how to use the fire-extinguishing equipment provided.

2.1.2 Immediate Action in case of Fire

(a) If you are the first to notice the fire, raise the alarm in the way laid down in the instructions of the building involved and, if appropriate, call the fire brigade.

(b) Find out at once whether human lives are in danger; rescue has priority over fire-fighting.

(c) Do what you can to extinguish the fire while waiting for the fire brigade to arrive, trying especially to prevent the fire spreading to areas still unaffected.

(d) If members of staff hear an alarm and are not involved in the incident of the fire, they must carry out the instructions displayed in the building. **Always** take a fire alarm signal to mean there is a fire.

(e) If you have to leave a building, close the windows and doors of the room you are vacating. Switch off any electrical apparatus in the room.

2.1.3 Ventilation after Extinction of Fire

Any area in which a fire has been extinguished must be thoroughly ventilated; this is especially important where a discharge of C.T.C., Methyl-bromide or CO_2 fire extinguishers has taken place.

2.1.4 Maintenance of Fire-fighting Appliances

At premises controlled by Engineering Division, and where there is no BBC Fire Services staff, the Engineer-in-Charge is responsible for ensuring that all fire-fighting appliances are maintained in good condition.

2.1.5 Soldering Irons

Soldering irons must not be left switched on in unoccupied areas and wherever possible must be used with an efficient soldering-iron stand.

2.2 Accidents and First Aid

2.2.1 Calling Medical Aid

(a) If injury or illness occurs on BBC premises, the case must be referred at once to Matron or a nurse, or, if none is available, to a first-aider. In cases of acute illness or serious accident resulting in much bleeding, or where shock is present, a doctor or ambulance, whichever is quicker, must always be called without waiting for the arrival of Matron, nurse or first-aider.

(b) All Engineering Staff concerned with electrical equipment must make themselves acquainted with the approved method of dealing with cases of electric shock (see Section 3.3.11). In cases of severe electric shock a doctor or ambulance must be called, whether or not a nurse or first-aider is available. In cases of less severe shock Matron, a nurse, or, failing them, a first-aider should be consulted before any further action is taken. If resuscitative measures are necessary, they must be begun **at once** and not delayed while a doctor is being called or a nurse's advice is being sought.

(c) To obtain a doctor, apply to PBX. If there is no PBX, or the PBX is not staffed, apply to the senior engineer on duty.

2.2.2 Reporting of Accidents

Reporting of accidents must be carried out as required by Staff Instruction S.I. 232 and Engineering Establishment Instruction T. 201.

2.2.3 First Aid Boxes

(a) Under the Factories Act, 1961, the Factories Act (Northern Ireland) 1965 and the Offices, Shops and Railway Premises Act 1963 first-aid boxes must be provided. They must be clearly marked and readily accessible and must be under the charge of a responsible person; where 50 or more persons are employed (in offices 150), this person must be a certificated first-aider and a notice must be displayed giving the name of this trained person. If the responsible person is a shift worker or if he works away from his base from time to time, the names of all the people who are responsible for each box at different times must be displayed near the box.

(b) All first-aid boxes must be constantly maintained to the prescribed standards given in the relative Statutory Instruments, published by H.M. Stationery Office. These are, for Factory Areas, 1959 No. 906 and, for Offices, 1964 No. 970. In Northern Ireland they are: The First-Aid Boxes in Factories Order (Northern Ireland) 1960, S.R. & O. of Northern Ireland 1960, No. 86, and the Building Operations (First Aid Boxes) Order (Northern Ireland) 1960, S.R. & O. of N.I., 1960, No. 87.

2.3 Mechanical, Chemical and other Non-electrical Hazards

2.3.1 Portable Ladders (see Section 3.4.1)

(a) Ladders must be erected firmly to avoid the possibility of slipping.

(b) They must be long enough for a safe hand-grip on the ladder to be obtained at the required height, and long ladders must be ascended carefully and slowly so as not to set them into oscillation.

(c) Ladders set in passage-ways must be specially secured.

(d) When ladders are left in the open when not in use, all precautions must be taken to prevent access by unauthorized persons and to prevent them from being removed.

(e) Ladders must be inspected at regular intervals; those in daily use must be inspected once per week. In either case the date and result of the inspection of each ladder must be recorded.

(f) Faulty ladders must immediately be taken out of service for repair.

(g) Beware of overhead conductors when carrying ladders, especially metal ladders.

(h) When working on metal ladders special care must be taken not to come into contact with electrical wiring or other conductors that might in any circumstances be live. Ladders used in conditions where this might occur should, wherever practicable, be provided with insulating feet.

2.3.2 Lighting of Plant Areas

Plant areas *and associated passages* must be sufficiently lit to enable staff to move about without danger.

2.3.3 Machines and Machine Tools (see Section 3.4.2)

(a) Protective devices such as belting guards, covers or shrouds must always be in position when machines, including hand-operated machines of a potentially-dangerous character, or machine tools are in use or are running. Such protective devices and also electrical protective devices may not be removed or rendered inoperative for any purpose whatever, unless the machine is stationary and has been deliberately immobilized to prevent its operation while the protective devices are out of action.

(b) Heads of Departments and Engineers-in-Charge responsible for premises classified as Engineering Premises should seek advice, when needed, from the local Factory Inspector and inform the appropriate Superintendent Engineer if agreement is not reached within the framework of BBC practice.

(c) It is the responsibility of the Supervising Engineer to ensure that mechanical and electrical protective devices under his control are maintained in good order, and that all staff under his control using potentially dangerous machines, whether operated by mechanical power or by hand, are properly trained in the use of the machines and are properly supervised to ensure that Regulation 2.3.3.(a) is complied with.

(d) Shatter-proof goggles must be worn or protective shields must be in position during all grinding operations.

2.3.4 Picture Monitors and Receivers

The Regulations under 2.6.10 apply to all picture monitors and receivers whether used in television studios or elsewhere.

2.3.5 Tape Recorders (see Section 3.4.3)

(a) The mechanical parts of sound and video tape recorders must not be touched while they are running at high speed. In no circumstances may 'braking' be applied by hand when a tape breaks and the parts are still running.

(b) Video and sound tape equipment which can be started remotely must be switched to *Local* before it is handled, e.g. for the insertion of tape, and it must not be restored to *Remote* until it has been ascertained that all staff are clear of all equipment controlled by the *Local/Remote* switch.

2.3.6 Camera and Microphone Mechanical Mountings

Various mechanical hazards are met with in the mechanical mountings of cameras and microphones, and the Regulations under 2.6.8 must be complied with.

2.3.7 Enclosures, Cubicles and Rooms containing Technical Equipment

(a) Doors or gates of non-interlocked enclosures, cubicles and rooms must not be locked or fastened in such a way that they cannot be easily and immediately opened from the inside. They must be kept free of all obstruction. (See Regulations 2.7.2(g), (h) and (k).)

(b) Where switchgear is concerned, panels or gates giving access to the back of flat-back or panel-type switchgear must be kept locked except where it is necessary to carry out work as provided for in the Regulations under 2.5.

(c) At studio centres, switchrooms and rooms of similar kind must be kept locked to prevent entry except by staff acting under the instructions of the Senior Engineering Representative on Duty.

(d) The storage of materials, tools or apparatus of any sort in switchrooms or behind open-type switchboards is prohibited except for a limited number of spare parts such as fuses etc., which may be needed for quick replacement on the neighbouring switchgear.

2.3.8 *Smoking*

Smoking is strictly prohibited, and notices must be posted to that effect, in the following places:

(a) Rooms containing storage batteries and in all stores containing petrol, oil, paraffin, methylated spirit, film-waxing solution, film cement or other flammable liquids, or explosives.

(b) Recording rooms where there is exposed swarf or other highly flammable material.

(c) Rooms in which film of any type is used or stored.

(d) Rooms where polytetrafluoroethylene (P.T.F.E.) is handled or worked, except where authorized for production purposes (in which case, special precautions must be taken).

2.3.9 *Oil-fired Boilers*

Work carried out on boilers must be done in accordance with local instructions issued by the engineer responsible. A copy of these instructions must be posted in each boiler house.

2.3.10 *Oil-storage Tanks*

(a) Arrangements for entry to a tank must be made only through the Head of Department concerned.

(b) Smoking and the use of matches, electric fires or naked lights of any sort is prohibited within 50 feet of the open vents of tanks.

(c) Where a tank is nearer to a building than 50 feet appropriate precautions must be observed during all filling operations.

2.3.11 *Compressed-air Equipment*

No repair or maintenance work may be started on compressed-air equipment until the valves controlling the supply of air to the equipment have been closed and the air has been released from the receivers and associated pipework, which must then be left open to atmosphere.

It is strictly forbidden to direct a stream of compressed air at any person.

2.3.12 Lifting Gear

(a) There must be a regular routine inspection of all lifting gear, as required by the Factories Act and for insurance purposes. The recommendations contained in the following pamphlet must be carried out in all cases where they are applicable:

> The use of Chains and other Lifting Gear, Safety Pamphlet No. 3, Ministry of Labour and National Service. Published by H.M. Stationery Office.

(b) All users of lifting gear must ensure beforehand that the particular gear they require to use is in serviceable condition.

(c) If, as a result of defects in a piece of lifting gear, repairs have been made, a new certificate must be obtained to satisfy the insurance requirements.

(d) Other items of supporting equipment, such as hanging brackets, scenery brackets, gallery clamps, camera scaffold-tube clamps, etc. which do not require test certificates, must also be regularly inspected and maintained.

2.3.13 Welding

The recommendations contained in the following pamphlets must be carried out in all cases where they are applicable:

> Memorandum on Safety Measures required in the Use of Acetylene Gas and in

Oxy-acetylene Processes in Factories, Form 1704, Factory Department, Ministry of Labour and National Service. Published by H.M. Stationery Office.

Memorandum on Electric Arc Welding, Form 329, Factory Department, Ministry of Labour and National Service, Published by H.M. Stationery Office.

Note: Up-to-date lists of these Memoranda and Safety Pamphlets can be obtained from H.M. Stationery Office.

2.3.14 Film Equipment

Various mechanical hazards are met with in film equipment. In this connection the Regulations under 2.6.3 must be complied with.

2.3.15 Handling of Dangerous Chemicals

Engineers-in-Charge must ensure that staff are aware of the precautions to be taken in handling dangerous chemicals, particularly acids and alkalis used in batteries and many of the chemicals used in processing colour film.

Industrial type plastic eye-shields and rubber or plastic gloves must be worn by staff handling battery electrolyte and when not in use must be kept near the store of electrolyte. Face-masks, goggles and rubber gloves must be provided for the use of staff mixing colour-film processing solutions and staff must use them. Instructions about the use of these protective devices, and warning notices, must be displayed near the stocks of dangerous chemicals.

Recommendations for first-aid treatment following accidents with chemicals are contained in Section 3.3.

2.3.16 Perchlorethylene and Trichlorethylene

The precautions laid down in Transmitter Group

Standing Instructions must be taken when handling these chemicals, which are used as primary coolants in the artificial loads at television and v.h.f. transmitting stations. These Instructions also give the first-aid treatment for accidents, but a notice giving the safety regulations and the first-aid instructions must be posted in every place where either of these chemicals is used. (Other names for them are 'perklone' and 'triklone'.)

2.3.17 Butane, Propane and Ether

During the storage or transport of butane or propane, the cylinder must be kept upright and the valve must be tightly closed and its outlet sealed by the inner safety cap or plug provided. The outer protective cap must be in good condition and tightly screwed down. For precautions in carrying ether, see 2.3.20(c).

2.3.18 Carbon Tetrachloride (C.T.C.) (see Section 3.4.8)

C.T.C. must not be used as a cleaning agent.

2.3.19 Tanks, Pits, Manholes and other Holes at Ground Level

Accessible open tanks, pits, open manholes and other holes opened at ground level and similar hazards must be protected with temporary guard rails. Garage pits must be protected at all times either by properly fitted floor-boards or by stout guard-rails or by heavy chains and posts.

2.3.20 Motor Vehicles

(a) Besides the normal tow-bar fitting, a safety wire, cable or chain of adequate strength must be used between a trailer and its towing vehicle.

(b) Whenever maintenance work is done on a battery operated vehicle, the battery must first be disconnected.

(c) Ether used for starting mobile diesel generators must be contained in the special capsules in which it is supplied. It must not be carried in the driving compartment of any vehicle.

2.3.21 Mechanically Propelled Trucks

(a) No person may drive a fork-lift truck or other mechanically propelled truck or tractor unless he has had an approved course of instruction (lists of persons so trained are held by Heads of Departments). Anyone driving a fork-lift truck must in addition hold a permit to do so, issued by the appropriate Department.

(b) Passengers may not be carried on mechanically propelled trucks unless these are specifically designed for the purpose.

(c) Notices prohibiting driving by unauthorized persons and the carrying of passengers must, where appropriate, be affixed to such mechanically propelled trucks.

2.3.22 Lifting and Carrying

Staff who have to handle heavy objects must learn the correct methods of taking the strain and must not attempt to lift or carry, unaided, anything too heavy for them to manage comfortably alone. (See Safety Health and Welfare Booklet No. 1, obtainable from H.M. Stationery Office.)

2.3.23 Spray Painting, including Aerosol Sprays (see Section 3.4.10)

(a) Spraying, where not done in the open air, must be done in special booths provided with extract ventilation, which must be maintained in operation while the work is in progress.

(b) Only the amount of paint and thinners required for the work in hand should be kept in the spraying room at any one time, and in any case this amount must not exceed that laid down by the Local Authority in the relevant licence.

(c) Food and drink must not be brought into the area, and operators must use face masks unless the design of the booth renders them unnecessary. Owing to the risk of permanent lung damage, masks must, however, always be worn when spraying modern resin or polyurethane paints.

(d) Smoking and the use of naked lights are prohibited in any place where spraying is being done or where solvents or thinners are used.

Warning: The wearing of nailed shoes and the use of ferrous materials create a risk of striking sparks and particular care must therefore be taken in spray painting areas.

Note: Statutory rules about spray painting are given in the Cellulose Solution Regulations, 1934.

(e) All aerosols must be used strictly in accordance with the makers' instructions printed thereon.

2.3.24 Safety Equipment for use when working at Heights

(a) Where it is possible for a person working at a height to fall, a full safety harness of an approved type must be used.

(b) A safety belt of an approved type may be used as a restraining device to prevent the wearer reaching the edge of a platform on which he is working.

(c) Local instructions for the use of these devices must be strictly adhered to.

(d) For masts and towers the Regulations under 2.8.1 must be observed.

2.3.25 *Safety Helmets*

Safety helmets must be worn by staff engaged in operations in which there is a special risk of injury from falling objects, e.g., in rigging and de-rigging. Where there is a risk of contact with electrical conductors, the helmets must be of insulating material.

2.3.26 *Beryllium Compounds*

Semiconductors and other components containing beryllium compounds must not be broken open, cut, heated, ground or abraded in any way, because the dust or fumes given off are toxic. All expended semiconductors must be returned to Valve Section for disposal; broken ceramics must be handled with extreme care and Valve Section must be advised so that collection can be arranged. Certain types of equipment contain washers made of beryllium; they are readily identifiable as they look like a light cornflower blue ceramic. Other components may contain toxic materials and must not be cut or ground unless their composition is known to be harmless.

In the event of accidental exposure to fractured materials containing beryllium compounds, medical advice must be sought immediately.

2.3.27 *Hand Tools*

Hand tools must be kept in good condition and must be used only for the purposes for which they are intended; the user must make sure that nobody will be injured if a tool slips. (See Section 3.4.11.)

2.3.28 *Crawling Boards*

Where staff have need to cross a roof, and no walkways are provided, crawling boards must be used.

2.3.29 *Radio-active Smoke-detectors*

In order to secure exemption from compulsory registration of radio-active material under Statutory Instrument 2640/1962—the Radio-active Substances (Fire Detectors) Exemption Order 1962, the following rules must be complied with wherever radio-active fire-detectors are used in the BBC:

(a) No radio-active source must be mutilated.

(b) If there are reasonable grounds for believing that a source has been lost or stolen, notification must be given immediately by the quickest means available to a member of the Police Force and in writing to the Minister of Housing and Local Government as soon as practicable.

(c) All reasonable practical measures must be taken forthwith to recover the source.

(d) If there are grounds for believing that the container is broken or damaged or that any radio-active material has escaped from it, notification must be given to the Minister and confirmed in writing as soon as practicable.

The nearest office of the Company supplying the detectors should be consulted immediately if any of these circumstances arise, and any fire detector that becomes waste must be sent to or removed by a manufacturer of fire detectors of similar type.

2.4 Electrical Hazards: General

2.4.1 Work on Live Equipment (see Section 3.5.1)

Note: Special Regulations apply to television and sound receivers, power distribution circuits and switchgear, television equipment, transmitters, masts and aerials; they are given in Sections 2.4.11, 2.4.12, 2.4.13, 2.5, 2.6, 2.7 and 2.8 of the classified Regulations.

(a) *General*

Under the Factories Acts, the current Electricity Regulations are statutorily binding in all designated Factory Areas and also on Building Operations and Works of Engineering Construction. Their requirements must also be observed as far as is reasonably practicable in all other areas.

The Safety Regulations given below are intended to ensure compliance with the Electricity Regulations and apply to all equipment carrying voltages that could, in any circumstances, be dangerous.

In this section (2.4.1) the word 'supplies' means power supplies from the mains or from a local generator.

Wherever possible, maintenance work should be done with the equipment switched off and disconnected from the mains (see warning under Regulation 2.4.2). Only when this is not possible may work be done on equipment and wiring with live conductors exposed and then only in accordance with the Regulations below. If the equipment is on wheels or castors, brakes should be applied or the wheels should be chocked before work is carried out on the equipment.

(b) *Cleaning*

Cleaning work on equipment is not permitted where such work involves danger of electric shock, electrical burn or heavy short-circuit current.

(c) *Interlocks*

Safety interlocks are provided to protect both personnel and apparatus, and it is forbidden to cut them out to facilitate maintenance or fault-tracing work except with the permission of the Senior Engineering Representative on Duty, who is responsible for ensuring that the interlock is restored on completion of the work.

Regular tests must be carried out on all interlocks to ensure that they are functioning correctly.

Note: This Regulation does not apply to the ML6B SHF radio-link equipment, in which it is necessary to over-ride the interlock for maintenance purposes. The Regulations under (e) below must be observed.

(d) *Remotely-controlled Equipment*

When work is being done on remotely-controlled equipment,

(i) it is the responsibility of every operator having charge of such equipment, before applying power to it, to ascertain that no danger will arise from doing so,

(ii) it is the responsibility of each member of staff, before opening up remotely-controlled equipment, to ascertain that it will be safe while open and

(iii) great care must be taken in handling any remote-control components, particularly under test conditions, to ensure that the frame of such components is still earthed.

(e) *Access to voltages not exceeding 250 volts*

Note: The Regulations in this section do not apply to ringing current supplies in the range 17-25 Hz and 80-volt telegraph supplies, provided that (a) the internal impedance of the source is such as to limit the short-circuit current to 50 mA and (b) the physical dimensions of the exposed live part are such that it cannot be grasped in a way that does not permit release, even if the current is sufficient to cause cramp.

It may be necessary, for the maintenance, testing, repair or modification of electrical apparatus in which the voltage between any conductor and earth does *not* exceed 250 V r.m.s., for staff to have access to it while live* terminals, components or other conductors are exposed. No member of staff of whatever grade may carry out such work, or work of any kind where technical knowledge is required to avoid danger, unless he is authorized to do so and the conditions stated below are observed.

(i) He has the necessary experience and technical capability to carry out the work safely and understands the Safety Regulations applying to it. The Engineer-in-Charge, Head of Department or Senior Engineering Representative on Duty must satisfy himself on these points before authorizing any member of his staff to undertake work of this kind on any particular class of equipment. Any member of staff about to undertake such work, whether on his own initiative or on the instructions of his supervisor, must make sure that he is aware of any risks involved and is able to carry out the work safely; if in any doubt, he must seek guidance from his superior.

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*For definition of 'live', see Section 1.6.

No member of staff under 21 years of age may undertake work of the kind described above unless he is in possession of a certificate signed by the Head of the Engineering Training Department or by the Head of an Engineering Department in which he has worked (or by persons nominated to act on their behalf). The person signing such a certificate must take particular care to satisfy himself that the person to whom it is issued understands the risks involved in working on electrical apparatus and that his character is such that he is likely to bear such risks constantly in mind. The certificate must be counter-signed by the member of staff to whom it is issued. The text of both parts of the certificate is given in Appendix B.

(ii) A member of staff who has not been authorized as stated above to carry out work of the kind described may assist in such work provided he is fully competent to do so, that he understands the risks involved, that he is over 21 years of age and that he is working under the immediate supervision of a person authorized as described in (i) above.

(iii) Clauses (e) (i) and (ii) above do not apply to staff undergoing training, whether on formal courses given by Engineering Training Department or on attachment to other departments. The second paragraph of Regulation 1.1 applies to such staff.

(iv) No person may undertake work of the kind described above unless he is accompanied by an authorized person over 21, who must know how to switch off the electricity supplies and be able to render immediate assistance in case of need; the accompanying person must be present in the area so as to become immediately aware of any accident that may take place. Fault location, adjustments and research work are exempt from this requirement, provided that such special precautions are taken as may be necessary to prevent danger. The nature of the special precautions required will depend on circumstances and may include the use of insulated tools, and also of insulated flooring and insulating screens while the work is in progress to prevent accidental contact with the bays on which the apparatus is mounted or with any other mass of earthed metal. The nature of such precautions in particular cases will be the subject of local instructions.

(v) Only those electricity supplies that are necessary for the work in progress may be applied to the equipment.

(vi) Valve changes may not be made without first disconnecting the supplies to the equipment unless the design of the equipment is such that there is no risk of contact with live* conductors.

(vii) When units of equipment have been removed from their normal operating positions for test on a bench, or for any other reason, the supplies may be connected to them only through the types of connection normally used or through connectors designed for use with the equipment while undergoing maintenance, and earth connections must be restored, as in normal operation, before power is applied.

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*For definition of 'live', see Section 1.6.

(f) *Access to voltages above 250 volts*

Access to equipment or wiring where the voltage between any conductor and earth exceeds 250 V is strictly forbidden to all staff while live* terminals, components or other conductors are exposed. (Regulations dealing with isolation and earthing are given in Section 2.5.)

The only permitted exceptions to this Regulation are:

(i) where tests are made by means of insulated test prods and testing instruments of approved type appropriate to the voltage† and

(ii) where voltages exceeding 250 V are present in equipment operated from a supply at less than 250 V, e.g. in receivers, television monitors or television cameras. If it is necessary to work on such equipment while it is connected to the supply and with the covers removed, the utmost care must be taken to avoid risk of contact with conductors carrying higher voltages.

2.4.2 Work on Equipment which has been made dead for the purpose

When apparatus or circuits have been made dead so that work may be carried out on them, precautions must be taken to prevent them from being inadvertently made live while the work is in progress. These precautions include the fixing of notices to the isolator, circuit-breaker, switch or plug-and-socket connection through which the power is supplied, unless it is directly and continuously under the control, and within sight, of the person carrying out the work. Where there is a distribution board, the appropriate fuses must be removed.

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*For definition of 'live', see Section 1.6.

†Test prods must not be used on transmitter high-power d.c. supplies or on main a.c. bus-bars or similar high fault-current capacity circuits.

Warning: A dangerous shock can be received from an undischarged capacitor in a piece of equipment, even when it has been disconnected from all sources of supply.

2.4.3 Insulating Gloves

The use of insulating gloves as a protection against electric shock is strictly prohibited (for the use of gloves for other purposes, see Regulation 2.3.15).

2.4.4 Picture Monitors and Receivers

The Regulations under 2.6.10 apply to all picture monitors and receivers whether used in television studios or elsewhere. (See warning at the beginning of Section 3.7.)

2.4.5 Operation of Electricity Supply Authority's Switchgear

Staff are prohibited from operating the Electricity Supply Authority's switchgear except on the instructions of the Engineer-in-Charge or his authorized deputy. Such instructions will be given only as agreed with the Authority. (See Section 3.5.2.)

2.4.6 Fusing and Earthing (see Section 3.5.3)

Note: The following Regulations apply to equipment operated either from public supply mains or from a local generator. In addition special Regulations apply to power distribution circuits and switchgear (Section 2.5), television equipment (Section 2.6), transmitting stations (Section 2.7) and masts and aerials (Section 2.8).

(a) A single-pole fuse of suitable rating must be connected in the line conductor of the supply at a suitable point in the distribution system. Double-pole fusing must not be used except where the supply is derived from a double-wound transformer (as provided for in Regulations 2.4.10(c) and 2.4.12(a)).

(b) For certain types of equipment (including mobile equipment permanently installed in vehicles) drawing more than 10 amperes from the supply, additional protection may be required, such as an earth leakage protection system. Where the installation of such equipment is undertaken by any department other than Planning and Installation Department, the latter must be consulted.

(c) To comply with I.E.E. Regulations, the exposed metalwork of all electrical equipment must be properly earthed, except as provided in Regulations 2.4.7(a), 2.4.10(c) and 2.4.12 below.*

(d) The earth connection must be made before power is applied to the equipment.

(e) When a mains supply is available, whether at fixed installations or for mobile or portable equipment, the connections to it must be made through 3-pin plugs and sockets, and the electricity supply authority must be asked to provide an earth connection to which the earthing sockets are connected.

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* See 'Regulations for the Electrical Equipment of Buildings', published by the Institution of Electrical Engineers; also the British Standard Code of Practice on Earthing, C.P. 1013: 1965.

Where the supply is provided by a mobile generator, 3-pin plugs and sockets must also be used and the earthing sockets of each outlet must be connected to the neutral terminal at the supply source. (See Regulations 2.5.11(f) and 2.5.12.)

(f) It is the responsibility of the Engineer-in-Charge (or, where mobile or portable equipment is concerned, the supervising engineer responsible for that equipment) to ensure that all earth connections are maintained in good condition. Earth connections provided for mobile or portable O.B. equipment must be tested each time the equipment is set up, before the equipment is connected to the supply, preferably by means of a special tester of a type approved by Planning and Installation Department. If such a tester is not available, the resistance between the earthing socket and the neutral socket must be measured; the resistance must be sufficiently low to ensure that a fuse will blow if a short-circuit occurs. When a mobile generator is used the resistance should not be greater than 2 ohms. A check must also be made of the connections between the earth-pin of each plug and the chassis of the equipment to which it is connected.

(g) All exposed metalwork of the equipment and the chassis or body of any vehicle in which the apparatus is used must be bonded to the earth connection.

(h) The earth connections of all equipment at the same site, must, wherever practicable, be commoned and connected to a single earth. If this is impracticable, the installations must be physically separated from each other by a distance of at least 6 feet. If two single-phase equipments are powered by different phases of the mains supply they must also be physically separated from each other by a distance of at least 6 feet unless, in specialized installations such as television production studios, P.I.D. have approved the application of certain I.E.E. exemptions; this Regulation does not apply in locations where all the power supplies are monitored by adequate earth-leakage detection devices.

(j) When plant is withdrawn from service the continuity of the earth connections to other equipment must be maintained or made good.

(k) Where the supply is taken from a mobile generator the connection to the neutral point of the supply must, wherever possible, be bonded to an actual earth connection by means of a conductor of adequately heavy gauge. The earth connection may be an earth spike driven into the ground. Where it is not possible to obtain a satisfactory earth connection, the supervising engineer must take the greatest possible care to guard against the possibility of live conductors, whether inside the vehicle or external to it, coming into contact with the chassis or body of the vehicle or with any other exposed metalwork.

(l) Gas pipes must not be used as earths. Water pipes may be suitable provided the test called for in (f) gives a satisfactory result.

(m) When earth spikes are driven into the ground the greatest care must be taken to avoid contact with buried cables.

2.4.7 Portable Equipment and other Electrical Appliances (see Section 3.5.4)

(a) All portable electrical equipment and tools operated either directly or through a transformer from single-phase supply mains must be equipped with three-conductor flexible leads and connected to the supply by three-pin plugs and sockets. Any exposed parts of such appliances must be securely connected to the earth-pin while the appliances are connected to the mains.

An exception may be made if the appliance operates via a double-wound transformer of extra-low secondary voltage.

An exception is also made for all-insulated and double-insulated appliances and tools, i.e. where all metal parts are so enclosed or shrouded by insulating material that they cannot be touched, provided they carry the B.S.I. kite mark (but see (g) below) or have been certified by the Head of the Planning and Installation Department as conforming to the standard specified in B.S. 2769.

When screened cables are used, the flexible metallic screen (though it must itself be efficiently earthed) must not be used as the sole earth for the metal of the apparatus to which it is connected, unless such cables have a covering approval by the Head of Studio Planning and Installation Department for such use.

(b) All portable electrical appliances, including trolley-mounted equipment, and their flexible leads, must be inspected and tested, using equipment of an approved type, at intervals not greater than twelve months to ensure that the cable is securely anchored, that the line conductors are sound and that the earth conductor is continuous, in good order and in sound connection with any exposed metal parts of the appliance. The result of the test must be logged, together with the name of the person carrying out the test. Where the equipment is frequently moved, the Engineer-in-Charge will specify more frequent testing.

The insulation of the flexible leads must also be checked to ensure that it is in good condition and that no fractured strands of conductor have penetrated the sheath.

(c) No portable mains-operated appliances may be used in a bathroom, irrespective of whether the bath is in use. Electric shavers, however, may be used via a special shaver supply unit complying with BS. 3052.

When any portable mains-operated appliance is used in an area where there are exposed water or gas pipes, particular care must be taken to comply with Regulation 2.4.7(b) above (see also 2.4.6(l)).

(d) The operation of portable electrical appliances from the mains supply via auto-transformers is prohibited unless

- (i) they form an integral part of the equipment fed from them,
- (ii) this equipment is provided with a three-core lead and
- (iii) the common terminal of the auto-transformer windings is reliably connected to the neutral of the supply.

Warning: Certain commercially available mains power supplies for transistor radio receivers, possibly referred to as 'mains substitutes' or 'mains adaptors', contain auto-transformers and are very dangerous.

(e) Hand lamps operated at mains voltage must be of the all-insulated type approved by the Head of the Planning and Installation Department.

(f) No hand lamps or other portable electrical appliances operated directly from the mains may be used inside water tanks or boilers, in inspection pits in garages, on masts, in damp situations or in any other circumstances where an insulation failure could have particularly dangerous consequences.

Hand lamps used in such situations must be operated by batteries or through an isolating transformer either with a secondary voltage of 25 volts r.m.s. or with a secondary voltage of 50 volts r.m.s. and with the centre-tap earthed and bonded to the metalwork of such tanks, boilers, etc. Portable tools used in such situations must be operated from an isolating transformer with a secondary voltage not exceeding 110 volts r.m.s. and with the centre-tap earthed and bonded as described above.

(g) Plugs and sockets having outer metal shells and associated with voltages other than extra-low must have such shells securely earthed via the earth-pin, or by an additional connecting wire, unless the maximum short-circuit current that can be delivered by the supply is limited to a safe value (0·7 mA (peak) a.c. or 2 mA d.c.), in which case it is preferable that the metal shell should be covered with insulating material.

(h) When extension flexible leads are used with plug-and-socket connectors it must be arranged that breaking a plug-and-socket connection leaves the pins of the plug disconnected from the supply.

(j) Electrical appliances such as electric typewriters, erasing machines, duplicating machines and domestic sound and television receivers must not be operated with any protective covers or guards removed except where necessary for testing by authorized staff. Labels drawing attention to this point must be affixed to the appliances. It is advisable to disconnect such equipment from the mains when it is not in use.

(k) Electric heaters of the radiant type must be fitted with adequate protective guards.

(l) If the power supplied to a portable electrical appliance is obtained from a double-wound transformer external to the appliance, fuses of suitable rating must be connected either in the primary or in the secondary circuit; if the secondary circuit is provided with a centre-tap, this must be earthed and fuses must be connected in both legs of the secondary circuit (but for electrically operated musical instruments and the testing of a.c./d.c. receivers see Regulations 2.4.10 and 2.4.12).

(m) Certain studio microphones are operated from mains units, but are plugged into a patch-board carrying low and extra-low voltage. They must be used with plugs which cannot be inserted wrongly, and the microphone case must be securely earthed.

2.4.8 Generators, Motors and Motor-Generators

(a) Before maintenance work or repair is carried out on generators, motors or motor-generators they must be stationary and all supplies must be disconnected. Isolators must be opened and, where the facility is provided, locked in the open position. Danger notices must be fixed to the isolators and the keys of locked isolators must be retained by the persons carrying out the work on the machines and returned to the senior engineer on duty after the work is completed. The remote-control switching for machines must be in the *Off* position before the isolators are re-closed.

(b) While work is being carried out on a stationary high-voltage generator, the high-potential terminal or brush must be kept earthed. Special precautions apply to commutator-grinding (see Regulations 2.7.9).

(c) Padlocks on commutator guards must not be unlocked while the machines are running.

2.4.9 Storage-Battery Rooms (see Regulation 2.3.15 and Section 3.5.5)

(a) All naked lights must be kept away from storage-battery rooms. Smoking is prohibited and notices must be posted to this effect.

(b) All electrical fittings for use in battery rooms must be of a type approved by the Planning and Installation Department. No temporary lighting fittings may be used.

(c) While work is being carried out in a battery room, the doors and windows must be kept open or, if the room is totally enclosed, the ventilation fans must be kept running.

(d) Where there is a possibility of electric shock, the Regulations in 2.4.1 must be complied with. An insulating rubber mat or duck-boards must be used when maintenance work is carried out on a battery. The mat or duck-boards must be kept in good condition.

(e) On no account may wire brushes be used to clean the tops of storage batteries.

2.4.10 Electrically Operated Musical Instruments

(a) A clause is included in contracts with musicians engaged to play electrically operated musical instruments in BBC studios, reading as follows:

> All electric and electronic musical instruments must be provided with 3-core leads and 5-amp or 13-amp 3-pin plugs and the

exposed metalwork must be properly connected with the earth-pin of the plug.

(b) A member of the BBC engineering or Programme Operations staff must check in every case that the terms of the contracts have been complied with and that exposed metalwork is not connected either to the line or the neutral conductor of the mains lead.

(c) If for any reason these requirements have not been met, for example, where an artist is auditioned without contract, an isolating transformer must be used, fuses being inserted in both leads on the secondary side. The secondary must not be earthed. If two or more such instruments are in use, each must be provided with a separate isolating transformer.

(d) Artists must not be allowed to connect the instruments to the isolating transformers; this must be done by a member of the BBC engineering or Programme Operations staff.

(e) Permanently installed electric organs must have any exposed metalwork securely connected to earth while the organ is connected to the mains, and the earth connection must be regularly inspected and tested by a member of the BBC engineering staff.

(f) Notices drawing attention to the foregoing regulations must be posted in buildings where electrically operated musical instruments are, or may be, used.

2.4.11 Testing of Sound and Television Receivers and similar equipment when the Corporation is responsible: General (see Section 3.5.6)

Note: The following Regulations apply to all types of mains-operated television and sound broadcast receivers installed in nontechnical areas on BBC premises, or in the homes of members of staff if the maintenance of the receivers is the responsibility of the BBC. The Regulations under 1.10 about Danger Notices also apply.

(a) Maintenance work on a receiver may be done by members of the staff authorized to undertake such work by the Head of Department, Regional Head of Engineering or Engineer-in-Charge responsible for the maintenance of the receiver, or by a dealer appointed by him. No other person may remove the back or other protective panels of the receiver.

(b) BBC staff responsible for the maintenance of receivers must observe all other relevant BBC Safety Regulations. In addition, they must seal the back and any other removable panels of the receivers by means of retaining wires secured by lead seals impressed with the letters 'BBC'. The seals must be re-made after each occasion on which the receiver is dismantled. The seals may not be disturbed except by members of the staff responsible for maintaining the receiver. (Sealing pliers and suitable lead seals and wire can be obtained by requisition.)

2.4.12 Testing of Sound and Television Receivers and similar equipment when the Corporation is responsible: Equipment not fitted with double-wound mains transformers

Note: The following Regulations apply to the testing of a.c./d.c. receivers or any equipment not fitted with double-wound mains transformers and therefore subject to the possibility that the chassis may be live if the apparatus is operated directly from the mains. These Regulations apply to the testing of such equipment whether in a workshop where such testing is regularly carried out or elsewhere.

(a) The supply for testing each receiver must be furnished through a 1 : 1 isolating transformer with the secondary winding not earthed. Fuses of appropriate rating must be inserted in both leads from the secondary winding of the transformer. If more than one receiver is being tested at the same time, a separate isolating transformer must be used for each receiver. The chassis of each receiver under test must be securely earthed.

(b) Any test equipment used with the receiver may be operated directly from the mains only if it incorporates a mains transformer. If it does not, a separate isolating transformer must be used for each item of test equipment. The cases and any other exposed metalwork of such equipment, and also of any electric tools used on the receiver, must be securely earthed.

(c) Where a capacitor or a resistor is incorporated in the receiver and connected between the chassis and the radio earth terminal, this capacitor or resistor must be tested for insulation or resistance respectively, the receiver being entirely disconnected from the mains supply while this test is made.

(d) If bench lights have to be used in workshops where receivers are tested, they must have exposed metalwork securely earthed.

(e) When a receiver is of the a.c./d.c. type, this fact must be clearly indicated by a notice on the back and this notice must state that the receiver may not be used with the back cover removed. Staff authorized to carry out maintenance work on such receivers must take particular care

(i) Not to remove the back cover or other protective covers until both poles of the mains supply have been disconnected,

(ii) if it is necessary to restore the mains supply when the chassis is exposed, not to come into contact with the chassis or any other metal parts that may be live and

(iii) after the work has been completed, to see that no metalwork in contact with the chassis, including spindles and screws, is left exposed.

2.4.13 Maintenance of Sound and Television Receivers when members of the BBC staff are responsible

Where a member of the staff has been provided with a receiver or authorized to rent one, on the understanding that he is responsible for having it properly maintained, he must ensure that the maintenance work is done by a responsible dealer, and must understand that the Corporation has no responsibility for any dangerous condition that may result. In exceptional cases, a member of the Engineering Staff to whom a receiver has been supplied may himself be authorized by the Head of his Department to carry out maintenance work on it.

2.4.14 Radio-frequency Radiation (see Section 3.5.7)

Note: For X-radiation hazards see Regulation 2.4.20.

(a) Staff who find themselves working in conditions where body tenperature rises because of a high electromagnetic field must immediately leave the vicinity of the high field and report the matter to the engineer in charge of the work. In such cases medical examination must be undertaken promptly and a report made in accordance with Regulation 2.2.2. In addition, the case must be reported to Corporation Medical Adviser through the Head of

Department or Engineer-in-Charge, together with the name and address of the local doctor.

(b) Where VHF, UHF or SHF power is being radiated, care must be taken because injury can occur without appreciable increase in body temperature. Staff working on equipment radiating power at VHF, UHF or SHF must avoid the risk of subjecting the body to such radiation. Such a risk could be incurred by looking down a powered waveguide or by examining a highly-directional radiator at close quarters.

(c) The covers of equipment liable to produce dangerous radiation with or without the covers removed must be labelled to this effect.

(d) The present recommended limit of radiation intensity for long-term continuous exposure is 0.01 watt per square centimetre, equivalent to a field strength of 200 volts per metre. This intensity is to be measured by a prescribed method, for which equipment is available.

Access to any area where there is a possibility of this intensity being exceeded must be restricted to authorized staff by means of fences, locked gates and appropriate danger notices. Access to such areas by authorized staff may be permitted only when the intensity is below the safe value.

(e) Members of the public, and staff not required as part of their duties to work in areas where strong radiated fields may exist, must be kept away from such areas, because of the possibility that such persons may have had bone fractures repaired by metal or plastic implants or may depend on cardiac pacemakers. Medical advice must be sought before members of staff known to be using such devices are employed on work that would expose them to such radiation.

2.4.15 Covers of Apparatus (see Section 3.5.8)

(a) The covers of all amplifiers and other apparatus which may in any circumstances be live must be kept in position during operation except as permitted in Regulation 2.4.1.

(b) If a cover is taken off for a period for maintenance or other purposes, e.g. because temporary wiring has been connected to the unit, a warning notice must be placed above the exposed supply terminals and, where possible, the unit must be railed off.

(c) Electrical equipment must not be exposed avoidably to rain or other sources of moisture. Waterproof covers must be used where appropriate and all equipment containing lamps, junction boxes or electric motors must be protected as far as possible.

(d) When non-ventilated protection has had to be applied to lamps and other equipment which might overheat in operation, covers must always be removed before the equipment is energized.

(e) If electrical equipment has to be operated in the presence of rain or moisture, special care must be taken to keep members of the public and staff not directly concerned away from any potential source of danger thus arising. (See also Regulations under 2.4.6.)

2.4.16 Extending Towers and Masts

The Regulations under 2.8.8 must be complied with.

2.4.17 Electrical Storms: Radio Link or Receiving Equipment

(a) Should there be a serious electrical storm in the immediate vicinity of a radio link station or receiving point, and in the opinion of the supervising engineer there is appreciable risk to staff, the equipment must not be handled until the storm centre has passed away from the vicinity.

(b) If damage from lightning has occurred, staff must not touch the damaged equipment until the storm has left the vicinity and the equipment has been discharged to earth.

2.4.18 Supply Cables for Outside Broadcasts

When the supply cables for outside broadcasts are connected to the supply by means of plugs and sockets, the following Regulations are to be observed:

(a) the female half of the coupling must be on the supply side,

(b) no running-out, connecting or disconnecting of cable may be carried out while the supply is switched on and

(c) couplings of a type approved by the Planning and Installation Department must be used.

(d) No connection may be made to any 'Roticon' or similar connecting box handed to an Electricity Supply Authority for the purpose of picking up a mains supply until:

  (i) the Supply Authority has confirmed that the box has been connected to a single-phase supply,

  (ii) tests have been made to check that the supply is connected to the correct terminals, that live and neutral are not reversed, that the earth pin is connected to earth and that the potential difference between live and neutral does not exceed 240 volts r.m.s. and

  (iii) it has been confirmed that there is no cross-over in the lead extending the supply to the apparatus and that the earth lead from the apparatus is continuous to the earth pin on the supply plug.

(e) All 3-pin sockets must be tested in accordance with Regulation 2.5.12.

2.4.19 Cleaning of Technical Areas

Where cleaners are required to operate in technical areas in which potentially dangerous equipment is exposed, danger notices must be placed on the doors of such areas and on the equipment itself. When such notices are displayed, the cleaning must be done in the presence of a responsible second person.

In all technical areas cleaning must be confined to the floor of the room and to entirely innocuous furniture except where it is done by engineering staff.

2.4.20 X-radiation

In certain equipment (for example, telecine, film telerecording, optical standards conversion, picture monitoring and receiving apparatus) using cathode-ray tubes with voltages exceeding 18 kV, there is a danger that X-rays may be emitted from rectifiers, stabilizers or the cathode-ray tubes themselves, and the following precautions must be observed:

(a) All staff working on such equipment must be warned of the danger of X-radiation, particularly when the screening covers are removed.

(b) If it is necessary to operate the equipment with the screening covers removed, maintenance staff must be instructed to keep the extra-high voltage switched off except when it is necessary to enable adjustments to be made. Where temporary screening covers are provided for maintenance use, these must be in position before the equipment is powered.

(c) Warning notices must be attached to the permanent covers of all equipment liable to radiate X-rays. These should state:

> Danger—Radiation: Consult Local Instructions before removing cover.

(d) Local instructions relating to work on such equipment, and to the checking of radiation levels, must be observed. Any member of the staff who feels that he may receive a dangerous amount of X-radiation should report the matter to his supervisor, who will make a check, either by arranging for a suitable film badge to be worn, or otherwise. (Arrangements have been made with the Radiological Protection Service for the supply and processing of films used in such badges.)

2.5 Power Distribution Circuits, Wiring and Switchgear (see Section 3.6)

Note: The Regulations in this section apply to all medium-voltage and high-voltage circuits and switchgear except where otherwise stated. The Regulations under 2.4.1 apply generally to all circuits and switchgear, and particularly to those operating on low-voltage supplies (see Definitions in Section 1.6).

2.5.1 General

No work of any description involving access to conductors which may in any circumstances be live may be carried out on any part of a power distribution system unless

(a) such part is dead (i.e. at or about earth potential) and isolated at all points from any live system and

(b) all conductors are efficiently connected to earth at those points where they have been isolated from the supplies or

(c) the work is to be carried out on medium-voltage circuits and is such as can be done by using test prods and testing instruments of approved types appropriate to the voltage.

Requirement (a) applies to all high-voltage and medium-voltage circuits, except for tests made with properly insulated and approved devices. Requirement (b) applies to all high-voltage circuits and also to medium-voltage circuits in the following cases:

(i) wherever special earthing equipment is provided,

(ii) wherever there is any possibility of the circuit accidentally becoming live during the execution of the work or

(iii) wherever capacitors are connected across the circuit.

Regarding requirement (c), test prods must *not* be used on high-voltage circuits.

When any oil-filled switchgear, power transformer, power-factor correction capacitor, motor starter or the like is opened up after a failure, any air space above the oil must be ventilated.

The isolation of withdrawable metal-clad circuit-breakers after they have operated as the result of a fault must be delayed for at least ten minutes to allow for the dispersal of any ignitable gases in the live spouts.

2.5.2 Isolation of Sections of Distribution System

(a) When sections of a power distribution system are to be isolated, the power must be removed by oil circuit-breakers or air circuit-breakers **before** the isolators are opened, unless the isolators are designed for on-load operation.

(b) When power has been removed by the operation of oil circuit-breakers or air circuit-breakers, these breakers must not be re-closed until **after** the isolators have been re-closed.

(c) All phases of the part of the system concerned must be isolated even though work is required on one phase only.

2.5.3 Safety Checking and Earthing of Medium-voltage Power Circuits

(a) No connection to earth may be made until it has been verified that the part of the system concerned is completely isolated from all supplies. (For high-voltage systems see also Regulations 2.5.4.)

(b) When parts of a power-distribution system have to be earthed after isolation, earthing switches and any other special earthing apparatus provided must be used. With medium-voltage systems comprising open-type distribution switchgear, fuse distribution boards and their associated cables and apparatus, the earthing operation must not be carried out until the following sequence of operations has been completed:

(i) Remove power from the circuit or apparatus to be worked on, in accordance with Regulation 2.5.1.

(ii) Lock off the isolator where the facility exists or apply an approved danger notice where no facility exists.

(iii) Remove the circuit fuse or fuses from the distribution board or boards.

(iv) Make a voltmeter test phase-to-phase, phase-to-earth and neutral-to-earth to check that no voltage exists.

(v) Even if only a few volts appear between neutral and earth the apparatus must not be touched by hand until the neutral has been isolated.

(vi) The voltmeter and the insulation and continuity of the leads and prods must be verified both before and after the test is made.

(vii) Apply a test earth to the circuit to be worked on. This earth must comprise an insulated wand connected by a 19/.083″ insulated conductor earthed solidly at one end through a bolted connection.

(viii) Apply the final earth connection consisting of a 19/.083″ cable with bolted clamps to make a complete short-circuit to earth at the point where the initial test was made.

(ix) Before work is begun on medium and low-voltage switchgear of the open-panel type, the cables feeding the switchgear should be isolated at the end remote from the switchboard, but if this is not possible, then the live end at the switchboard must be protected by an insulating cover, the live sides of isolators and switchgear must be similarly protected and Danger Notices must be placed at these points.

(c) Rubber mats are provided for use with live-front switchboards. These mats must be maintained in good condition, and be in position when the switchboard is used.

2.5.4 *Safety Checking and Earthing of High-voltage Power Circuits*

(a) Checking of high-voltage power supply equipment to ensure that it is dead, as required in the following clauses of this section, must be carried out by BBC staff using only the approved type of detector supplied for this purpose. If such a detector is not available, the services of the local supply authority must be called upon to carry out the testing.

(b) The approved detector must be tested on its proving unit before and after the verification.

(c) Such detectors must not be used on d.c. busbars.

(d) The above precautions must be taken irrespective of any previous steps that have been taken to render the circuits dead.

(e) No conductor of a high-voltage system may be touched until this conductor has been not only isolated from all sources of high voltage but also solidly earthed.

(f) Earthing wands must not in any circumstances be used on high-voltage a.c. power-supply circuits; in the event of these circuits being live, the person using the earthing wand would in all probability sustain fatal injury.

(g) The earthing of high-voltage systems for maintenance purposes must be done only by use of the earthing equipment supplied specially for the duty. This equipment must not be interfered with in any way, and it is expressly forbidden for earthing to be effected by the manual insertion of an earthing conductor into the spouts of switchgear.

2.5.5 Work on High-voltage Switchgear

(a) Where isolators are associated with circuit-breakers these isolators must be kept open while work is being done on the breakers. Where padlocking facilities are provided, the isolators must be kept locked in the open position. Danger Notices to indicate that they must not be closed must be affixed to the isolators. The keys of locked isolators must be retained by the person carrying out the work on the breaker until the work is completed, when the keys must be returned to the senior engineer on duty. Where a means of earthing the isolator is provided, this must be used, but only after the precautions specified in local regulations have been taken so as to ensure that no part of the system is earthed while connected to the supply.

(b) Metal-clad circuit-breakers must be fully racked out and truck-type breakers withdrawn from their cubicles before work is started on them.

(c) Where oil circuit-breakers have been racked out, the connection-spout shutters must be locked shut.

(d) Where access is required, via the cable spouts, to a cable that has been isolated, the spout shutters of the cable may be unlocked by the senior engineer on duty and the cable must be tested by means of the detector (see Regulations under 2.5.4) and then earthed by the means provided. The Permit-to-Work procedure given in Regulation 2.5.10 must be carried out before work is started.

(e) Manual-operation handles provided with solenoid-operated circuit-breakers must not be used except when the breakers are racked out or otherwise withdrawn from circuit. The handles are to be used for maintenance work only. They must not be stored where they are accessible to all staff; they may be issued, on the instructions of the senior engineer on duty, only when maintenance work is to be carried out on the breakers.

(f) All precautionary measures taken in connection with work on power switchgear must be closely supervised by the senior engineer on duty. If a Specialist Department is responsible for the work, the precautionary measures must be supervised by a responsible engineer of that department (see Regulations under 1.7). For high-voltage switchgear the Permit-to-Work procedure of Regulation 2.5.10 must be followed.

2.5.6 Work on Power Transformers

(a) Before work is carried out on power transformers, both the circuit-breaker controlling the primary and the circuit-breaker, switch or contactor controlling the secondary must be opened and both primary and secondary must be isolated.

In the primary circuit:

(i) if the circuit-breaker is of the metal-clad type it must be racked out and padlocked;

(ii) if the circuit-breaker is of the truck type, the truck must be withdrawn and a Danger Notice securely fixed to the circuit-breaker handle. The cubicle must be padlocked if the facility exists;

(iii) in cubicle-type switchgear, the isolators must be opened and the doors enclosing the isolators padlocked.

In the secondary circuit:

(iv) if the circuit-breakers are of the type which can be isolated and padlocked, this must be done;

(v) if separate isolators are provided they must be opened, and, where applicable, any links or fuses removed.

(b) No work must be carried out on high-voltage transformers or their connecting cables unless their high-voltage windings have been earthed and the provisions of the Regulations under 2.5.6(a) have been carried out.

(c) All lock or padlock keys must be retained by the persons carrying out the work on the transformers until it is completed, when keys must be returned to the senior engineer on duty.

(d) All precautionary measures taken in connection with work on power transformers must be closely supervised by the senior engineer on duty. If a Specialist Department is responsible for the work, the precautionary measures must be supervised by a responsible engineer of that department (see Regulations under 1.7). For high-voltage transformers the Permit-to-Work procedure of Regulation 2.5.10 must be followed.

2.5.7 Work on Power Cables

(a) Before work is carried out on cables, the cables must be isolated from all sources of supply and tested to ensure that they are dead. Danger Notices must be affixed to the isolators.

(b) All conductors in a high-voltage cable must be solidly earthed after isolation and before work is carried out on the cable (see Regulations under 2.5.4).

(c) Where isolators are provided with locking facilities these must be used. The keys must be retained by the persons working on the cables until the work is completed; they must then be returned to the senior engineer on duty.

(d) All precautionary measures taken in connection with work on power cables must be closely supervised by the senior engineer on duty. If a Specialist Department is responsible for the work, the precautionary measures must be supervised by a responsible engineer of that Department (see Regulations 1.7). For high-voltage cables the Permit-to-Work procedure of Regulation 2.5.10 must be followed.

(e) Where there is any doubt of the identity of a cable, it must be spiked in a manner approved by the appropriate Specialist Department.

2.5.8 Voltage Transformers

Voltage transformers must be withdrawn from circuit before any work is done on them; where separate isolator switches are provided, they must be operated before withdrawal.

2.5.9 Automatic Fire Protection Equipment

(a) Before maintenance or other work is carried out on the plant with which is associated automatic fire-extinguishing equipment, this equipment must be temporarily rendered inoperative to prevent the accidental release of gases.

(b) Whenever the fire-extinguishing equipment has been rendered inoperative notices must be hung on all doors giving access to the plant, stating that the equipment has been locked off. This does not apply where it is locked off automatically.

(c) Immediately the work on the plant is completed, the fire-extinguishing equipment must be restored to normal. The senior engineer on duty will be held responsible for ensuring that this is done.

2.5.10 Permit-to-Work Forms

(a) When plant has been taken over by the BBC, no work involving access to high-voltage power-distribution circuits other than solely via interlocked doors provided for that purpose may be undertaken until a *Permit-to-Work* form of the kind shown in Appendix A has been issued and receipted in the way laid down in the same Appendix, which also gives the rules that must be observed for clearance, cancellation and suspension of the certificate. A new Permit-to-Work form must be issued if the work has to be re-started after suspension.

(b) On stations shared by both the BBC and the ITA, if a Permit-to-Work is issued in respect of equipment used in a room common to both authorities, a copy must be given to the Engineer-in-Charge or Resident Engineer of the ITA (or his senior representative in his absence), who must be informed when the Permit-to-Work is cancelled.

2.5.11 Power-supply Wiring Systems

(a) Permanent extensions to, or modifications of, existing wiring installations must be carried out in accordance with the practices laid down by the Institution of Electrical Engineers,* except for the special installations approved by P.I.D. and referred to in 2.4.6(h).

(b) No temporary extensions to, or modifications of, existing wiring installations are permitted unless authorized by the senior engineer on duty.

(c) Where permanent or temporary extensions are made to an existing wiring installation, adequate fuses or automatic circuit-breakers must be provided to protect the circuit against excess current. Such fuses or circuit-breakers must be of adequate breaking capacity in relation to the maximum fault capacity at the point of supply of the extension.

(d) When additional or alternative equipment is connected to an existing wiring installation, the fuses or automatic circuit-breakers in the circuit to which the equipment is connected must be checked to ascertain that they will provide adequate protection of the equipment against excess current and conform with recommendations issued by the Head of the Planning and Installation Department. When an appliance is connected to a socket outlet the fusing of which is in excess of that required to provide adequate protection for the appliance and its flexible lead, a fuse of appropriate rating must be incorporated in the plug, or some other approved means of local fusing must be adopted.

(e) No single-pole switches or single-pole circuit-breakers may be inserted in the neutral conductor of a wiring installation. Where single-pole fusing is employed, the fuse must be in the live conductor and not in the neutral conductor.

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* See *Regulations for the Electrical Equipment of Buildings*, published by The Institution of Electrical Engineers.

(f) It is the responsiblity of the Engineer-in-Charge to ensure that a test is made on all 3-pin sockets on installation (whether temporary or permanent), or whenever any change is made, to confirm that the earth connections are in good order and that the live and neutral leads are not reversed. Tests should be made with equipment of an approved type.

2.5.12 Power Supply Sockets in Mobile Installations

It is the responsibility of the supervising engineer to ensure that all 3-pin sockets are tested in the manner described in 2.5.11(f) above each time the installation is set up for service.

2.5.13 Use of Temporary Metal-clad Switchgear

When temporary metal-clad switchgear or similar apparatus is used, the case must be securely earthed and the input power supply must be served to the correct side of the switch before connecting power.

2.5.14 Restoration of Power to Contactors and Circuit-breakers

When a contactor or circuit-breaker has opened or closed under a severe fault condition, an examination must be carried out before power is restored to ascertain that the contacts have not been damaged or welded together.

2.6 Studio, Film and Outside Broadcast Equipment

Note: All the following Regulations apply to television equipment. Some apply also to sound equipment and must therefore be observed by those engaged in sound broadcasting. The relevant Regulations in other sections of this book must also be complied with.

2.6.1 Studio Grid Areas

(a) Because of the danger from falling objects, only authorized riggers, scene men, electricians or maintenance engineers may handle equipment suspended from above the grid of any television studio. Where operational needs require any piece of equipment to be so suspended, including electronic equipment such as microphones, a rigger must be employed. (See Section 3.7.1(a).)

(b) Technical Operations staff are forbidden to enter the grid areas for any purpose, whether on or off duty, except as follows:

- (i) Staff specially authorized by the Superintendent of Television Technical Operations or Head of Technical Operations Television Studios.
- (ii) Technical Managers, Sound Supervisors or Sound Assistants I carrying out production requirements.
- (iii) Members of Technical Operations crews instructed to carry out work in the grid area by a Technical Manager or Sound Supervisor, who is responsible for ensuring that the Regulations are complied with.
- (iv) As provided for in Sections 3.7.1(a) and 3.7.1(b).

(c) Authorized staff entering the grid **for any purpose** must first put on pocketless clothing. No loose tools may be carried.

(d) When equipment must be suspended directly from above the grid, such equipment and its associated lead must be handled and secured by a rigger; the cable or lead must be tied off in such a way that it cannot slip through the grid even when unplugged. The plugging will then be done by an authorized member of Technical Operations staff.

The exact position of such suspended equipment may be varied by means of brails which may be operated by an authorized member of Technical Operations staff, but if the main suspension must be altered in any way, the rigger must be called to carry out the change.

(e) When equipment is to be operated at floor level (e.g. a microphone boom) or suspended on a lighting or scenic hoist (e.g. a picture monitor), it is permissible for the cable attached to the equipment to be drawn up into the grid area by an authorized member of Technical Operations staff by lowering a rope from the grid, but great care must be taken during the operation to ensure that the cable is properly tied to the rope before lifting begins and that it is secured and plugged in above the grid before the rope is untied. The cable must be additionally secured in such a way that no strain is placed on the plug and socket and that the cable cannot slip through the grid even if unplugged. Similarly, during de-rigging the rope must be securely tied to the cable **before** it is unplugged and released ready for lowering.

(f) When any of the above operations are taking place the Technical Manager or Sound Supervisor must warn everybody to keep the studio floor clear below that part of the grid where work is going on, and must post a member of the crew to police the area.

(g) No equipment may be stored in grid areas, even temporarily, because of floor loading restrictions. Any necessary equipment, such as lighting transformers for effects projectors, must be rigged specifically for the production and must be removed as soon as the immediate production requirements are at an end.

2.6.2 Production Lighting Equipment (see Section 3.7.2)

Warning: In some studios lighting barrels may be supplied from two phases of a 415-volt 3-phase network.

(a) Luminaires must be disconnected before being opened up for maintenance work.

(b) All luminaires both in studio and outside broadcasts, and irrespective of type, must be screened individually with wire-netting of one-inch mesh or smaller, as a protection against injury arising from lens or bulb fractures. Front-of-house lighting incorporating lenses of toughened glass, photofloods and nitrophot lamps are exempt from this Regulation.

(c) All luminaires of whatever type, when mounted on a gallery or other elevated structure, must be provided with a safety wire strop or other effective means of retention for securing the luminaire, in addition to the normal means of fixing—which must itself be fully capable of carrying the load. The additional means of retention and its fixing must be adequate to withstand the weight of the lamp applied suddenly, as in a fall.

Standing lamps must be weighted or lashed if there is any possibility that they may be knocked or blown over, and always when they are used near open water, for example a swimming-bath or pond.

(d) Where heavy equipment, such as a picture monitor or loudspeaker, is suspended above an audience, a wire strop or chain must be fitted in addition to the normal mounting.

(e) Barn-doors or diffuser-frames fitted in slots in the front of luminaires should be a good fit in the slots and must be fitted with safety strops or other effective means of retention.

(f) The metal framework of luminaires must be securely and efficiently earthed.

(g) When rigging of overhead lighting is taking place, all persons not engaged in this work must be kept at a safe distance.

(h) When luminaire lamp-bulbs are removed or installed, the safety bags provided must be used.

(j) In the event of a lamp-bulb exploding inside a luminaire, another bulb must not be fitted until the luminaire has been thoroughly cleared of all glass particles to eliminate the danger of such particles falling from it.

(k) No luminaire provided with a protective lens may be used without it. With compact source lamps, the housing must not be opened except by authorized staff wearing gloves and splinterproof goggles; if the lamp is alight, it must be switched off and ten minutes allowed for cooling before the housing is opened. As a further precaution against explosion, the lamp must be covered with the maker's protective bag before cleaning the reflector or handling, and must never be touched with bare fingers.

Equipment Manufacturers' instructions must be scrupulously followed if a lamp is to be removed.

(l) Special structures for television lighting must be erected by skilled riggers or rigger-drivers and not by electricians or other staff.

(m) When work is carried out in the open air or equipment is otherwise exposed to moisture, the Regulations under 2.4.15 must be observed.

2.6.3 Film Equipment and Film Handling (see also Regulations under 2.3.3)

(a) If, for purposes of inspection under fault-testing conditions, it is necessary to operate film-projection or similar equipment with any covers or guards removed, special care must be taken to avoid contact with any moving parts, and to prevent any part of the clothing being caught up in the mechanism. The guards or covers of film projectors may not be removed when flammable film is in use.

(b) Where a xenon lamp is in use the precautions given in 2.6.2(k) must be taken.

(c) Film equipment which can be started remotely must be switched to *Local* before it is handled, e.g. for film lacing. The equipment must not be switched to *Remote* until it has been ascertained that all staff are clear of this and any other equipment controlled by the *Local/Remote* switch.

(d) Before a film camera is mounted on a tripod, the head and legs of the tripod must be fully locked. Special care must be taken when a camera is being set up on a smooth (e.g. marble) surface. A spider must be used whenever possible.

(e) Hired equipment must be tested before use for earth continuity, faulty plug connections or unsatisfactory guards.

(f) All film must normally be kept in the film stores in the approved metal cans.

(g) Only such film as is needed for the work in hand should be held in a cutting room or projection box, and the maximum quantity of any film which may be out of the metal cans or in cans not properly closed at any one time is 10,000 ft. In projection boxes all film except that actually in projectors must be kept in the metal cans in the re-winding sections.

(h) Flammable film (i.e. film containing nitrocellulose) may only be stored or used in areas specially designated for the purpose and approved by the Local Authority concerned.

(j) The maximum quantity of film permitted in a store which contains any flammable film or is designed to contain flammable film is one ton and the maximum quantity of flammable film allowed in an approved projection box or cutting room is 20,000 ft, unless the conditions imposed by the Local Authority are more severe.

(k) Flammable film and safety film must never be wound on the same spool.

(l) When flammable film is being used in a projector, the spool boxes must be securely closed while the projector is working.

(m) The use of flammable film in studios (e.g. with back projection) is prohibited and not more than 5,000 ft of safety film may be used in a studio.

(n) Not more than two fluid ounces of flammable substance used for repairing or joining film may be kept in a projection or re-wind room. In a cutting room the quantity must not exceed two fluid ounces per operator. The flammable substance must be handled carefully and must be kept in a stoppered container.

(o) All safety regulations imposed by the Local Authority must be observed.

2.6.4 Studio Lighting Effects

(a) All live practicals involving unprotected lamps must be agreed between the designer and the technical manager or engineering manager to ensure that their placing does not constitute a danger to artists and staff.

Note: This applies to BBC premises and also to BBC designed scenery when used in other premises.

(b) Where fluorescent lights are used, dangerous voltages (sometimes high or even extra-high) may be encountered. The greatest care must therefore be taken to make the installation as safe as possible.

2.6.5 Studio Effects

(a) Electrically operated studio effects, including such items as electrically ignited pyrotechnics, cine flares and smoke bombs, must be installed by staff of Engineering Division or by members of the Special Effects Department. Water, steam, gas, compressed air, or electricity must be supplied by the staff of Engineer-in-Charge, House Services (Television) (or, in the Regions, Engineer-in-Charge, Services). (See Section 3.7.4.)

(b) Effects must not be located where they can cause danger to staff or artists or give rise to fire risk to sets or scenery. If potentially dangerous effects have unavoidably to be installed close to positions to be occupied by artists, or near combustible objects, either sufficient distance must be left between artist and effect, or some effective protection must be provided.

(c) Effects operated from the electric supply mains, whether directly or via a transformer, and effects involving the use of steam, must be operated by the staff of Engineer-in-Charge, House Services (Television) (or, in the Regions, Engineer-in-Charge, Services). Other effects are normally operated by non-engineering staff.

(d) The General Safety Regulations issued by Staff Administration must also be observed.

2.6.6 Broadcasts from Places to which the Public is admitted (see Section 3.7.5)

(a) All equipment to be installed in a place to which the public is admitted and all pins, fixings, bolts, nuts and ropes used for securing such equipment, must be carefully inspected before rigging and any defective items must be discarded. Special care must be taken to ensure that all equipment installed in such places is properly secured.

(b) Cameras and other equipment must not be placed in positions exposing the public to risk and must not be rigged or de-rigged in such a way as to involve the public in danger. Any equipment mounted on a platform, balcony or roof overlooking an area to which the public is admitted must be particularly well safeguarded, where practicable by the use of nets, and any object that is liable to be accidentally dislodged must be lashed down or otherwise secured.

Any scaffolding must have an adequate factor of safety and any ladders must be firmly secured to it. If possible ladders must be placed inside the scaffolding; if a ladder has to be placed outside the scaffolding, access by the public must be prevented. Scaffold platforms must be securely earthed.

Kicking boards must be fitted to any permanent balcony without a solid parapet if it is used as a camera platform. No work may be done on a camera or other apparatus while it is in an overhanging position: the equipment must be swung inboard before any work is done on it and the greatest care must be exercised while the work is being done.

Any seats around a camera or other equipment that cannot safely be occupied must be removed, unless a barrier is erected to ensure that they cannot be occupied even by members of the staff or their friends.

(c) In addition to the provisions of Regulations 2.6.2 concerning lighting equipment, safety chains must be used between barn doors and lamp housings, diffuser frames must be a good fit in their slides and, when barn doors are not used, there must be a safety bond.

(d) All hanging microphones must be suspended from a steel wire or a rope or sling of terylene, nylon or other appropriate material, which must be examined beforehand and securely attached. Microphone stands and any attachments to microphones, such as reflectors, must be securely lashed if there is any danger of overturning.

(e) Picture monitors, if not placed on the floor or safeguarded by parapets, must be securely lashed.

(f) Where lighting equipment or other mains-operated equipment is installed in an auditorium or other place to which the public is admitted, an extinguisher suitable for fires associated with live electrical equipment must be readily available in the area concerned.

(g) Unless arrangements have been made with the Local Authority and extra precautions have been taken, no obstruction whatever may be placed in the way of a safety curtain and no cables, however small, may pass through the proscenium opening.

(h) No cables or other apparatus may be so placed as to prevent the complete closing of fire-resisting doors.

(j) All luminaires installed on or over a stage must be so placed as to allow sufficient space to avoid the risk of overheating drapes, scenery, properties or other materials.

(k) No obstruction of gangways, corridors or doorways is permitted except as agreed by the Local Authority.

(l) Cable runs must be so placed that they do not constitute a danger to the public or impede the closing or opening of exit doors. Lighting or other equipment placed in an auditorium or other area to which the public has access must be protected by substantial barriers.

(m) All couplings used with radio link equipment must be tightened with the appropriate spanners and carefully checked. All tools and loose items of equipment must be brought down and stored in a safe place. Knots used to attach equipment to ropes must be made safe. All such ropes must be examined at specified intervals and in any case must be replaced at intervals of not more than two years. Cables connected to elevated equipment must be firmly secured in such a way that the weight of the cable is not applied to the equipment or to its mounting tripod. Areas in which radio link equipment is being rigged must be roped off.

(n) Mobile generators must be roped or railed off, when operating, according to the requirements of the local safety authority and danger notices must be hung on the ropes at appropriate intervals. This does not apply when the vehicle is parked on the public highway, unless required by the local police.

(o) The mains switch controlling the power supplies to television equipment must be accessible at all times.

(p) All safety regulations imposed by the Local Authority must be observed.

2.6.7 Lighting Effects at O.B. Points

Where the Corporation is responsible for the installation, the Regulations under 2.6.4(a) and (b) must be complied with.

2.6.8 Camera and Microphone Mechanical Mountings (see Section 3.7.6)

The following rules must be observed by those working on such mountings:

(a) Familiarize yourself with any safety devices incorporated in the mounting, and check that they are working properly.

(b) Before mounting a camera on a pedestal requiring stabilizing weights to be fitted to the base, make sure these weights are in place.

(c) Before removing a camera from its mounting, make sure that the appropriate safety lock, if any, is applied.

(d) Make sure that spare balance weights, if any, for the mounting are correctly stowed.

(e) Before using mobile equipment fitted with brakes, check that the latter are operating correctly.

(f) If the camera or microphone mounting is partially collapsible for ease of transport, make sure that when it is in the operating condition the locating pins or bolts are securely fixed.

(g) When electro-hydraulic camera cranes fitted with dual controls for the crane arm are to be used, the Engineering Manager or Technical Manager must define clearly which operational duties are to be performed by each of the two people concerned.

(h) Where safety belts are provided on a camera crane, they must be used correctly.

(j) On cranes with extra-high lift, insulated safety helmets must be worn by all those sitting on the boom arm.

2.6.9 Scaffold-tube Platforms

(a) The erection of scaffold-tube platforms by BBC Engineering Staff must comply with the following basic conditions:

- (i) The platform height for a free-standing rostrum must not exceed 12 feet for Outside Broadcast purposes or 15 feet in studios.
- (ii) The ratio of height to shortest side for a free-standing rostrum must not be greater than 2:1.
- (iii) Safety rails of adequate strength must normally be provided at a minimum height of

2 ft 6 in. above the platform. For Outside Broadcasts this minimum height may be reduced to 2 ft 3 in. if considered essential. If, for production reasons, part of the safety rail must be lower than these amounts, the operational staff on the platform must wear safety belts with lanyards securely attached to the safety rail elsewhere on the platform and of the correct length to prevent them going beyond the edge of the platform.

(iv) Kicking boards not less than 8 in. high must be provided.

(v) If equipment overhangs the edge of the platform, an approved form of safety net to catch falling objects must be provided wherever possible. If, for production reasons, safety nets cannot be installed, the appropriate Engineer-in-Charge must agree the alternative safety measures to be provided.

(vi) In certain instances, e.g. where audiences or the general public may have free access to the area around a rostum, the latter must be provided with adequate cladding. On some occasions, such as when camera rostra are erected in audience seating or standing areas at football grounds, cladding may be dispensed with if the public are kept away from the rostra by policing their immediate surroundings. (See Section 3.7.7.)

(b) If castors are used for ease of movement, baseplates must be fitted, either in place of or in addition to the castors, before the platform is occupied by staff or equipment.

(c) An access ladder, sloped where possible, must be provided and securely lashed to the scaffolding; it must be of sufficient length to ensure that the top of the ladder is not below the safety rail of the rostrum.

(d) A safe means (such as a derrick) of hoisting the equipment on to the platform must be provided.

(e) The scaffolding itself must be securely earthed, either by a mains earth connection or by an earth spike driven into the ground or, if neither of these alternatives is possible, by a connection between the camera mounting and the metal tubing of the platform.

(f) It is the responsibility of the Technical Manager or Engineering Manager to assure himself that the platform upon which equipment is to be mounted and operated is suitable. If he is in any doubt he must consult the designer or contractor, as appropriate, before staff mount the platform. If still not satisfied by this consultation, he must refer to higher engineering authority.

(g) No loose equipment of any kind may be left on the platform.

2.6.10 Picture Monitors and Receivers (see Section 3.7.8)

(a) A.C./D.C. Picture Monitors may not be connected to a.c. mains except through isolating transformers (see also Regulation 2.4.12).

(b) Any detachable glass protective screens of picture monitors must be in position during normal operation of the picture monitors.

(c) Staff whose work necessitates the handling of cathode-ray tubes must wear splinter-proof goggles and gloves for this work.

(d) Where a cathode-ray tube is provided with external and internal conducting coatings, these coatings must be connected together to remove any residual charge before the tube is removed from its housing.

(e) Supervising Engineers responsible for staff who are required to handle cathode-ray tubes must ensure that they are aware of the possible dangers and of the necessary precautions.

(f) Because of the potential danger of X-radiation from rectifiers, stabilizers and cathode-ray tubes operating at high or extra-high voltage, the Regulations set out in 2.4.20 must be complied with.

2.6.11 Film Telerecording, Optical Standards Conversion and Telecine Equipment

(a) Regulation 2.6.10(b) cannot be applied to the display tubes in film telerecording and optical standards conversion equipment, and therefore staff viewing such tubes must wear splinter-proof goggles or vizors of an approved type.

(b) Because of the potential danger of X-radiation from rectifiers, stabilizers and cathode-ray tubes operating at high or extra-high voltage, the Regulations set out in 2.4.20 must be complied with.

2.6.12 Television O.B.s in unusually Hazardous Conditions

(a) Certain outside broadcasts take place at unusual locations and may be accompanied by unusual risks. It is the responsibility of the Engineer-in-Charge to ensure that the staff concerned in them are fully competent to undertake the work and that they study the special conditions applying to it.

(b) Special precautions are necessary on outside broadcasts from helicopters, aeroplanes, ships, mines, under or over water and in other unusual situations. The staff concerned in such O.B.s must make themselves fully conversant with the special risks and precautions applying to them.

(c) Equipment installed in ships and aircraft must be appropriately secured so that no part of the equipment can fall overboard. It may be necessary that the operator himself should be strapped in.

(d) It is forbidden to use electrical equipment, including lighting equipment, in water, unless the equipment has been specially designed and constructed for the purpose.

(e) The regulations of the organization in authority at the location must be complied with; for example, in a mine, the regulations about wearing protective helmets and the taking of special precautions to avoid all possibility of sparks arising from faulty electrical connections or otherwise.

2.6.13 Suspension of Heavy Equipment

Where heavy equipment, such as a picture monitor or loudspeaker, is suspended, either in the studio or at an O.B. point, a wire strop or chain must be fitted in addition to the normal mounting.

2.7 Transmitting Stations: Special Electrical Hazards

2.7.1 General Regulations

(a) Before a transmitter is powered, the engineer responsible for its operation must first satisfy himself that no danger to peronnnel will be caused by the energizing of any part of the transmitter and its associated plant. He must also take every reasonable step to ensure that any maintenance or repair work which has been in progress is sufficiently complete to permit transmission, and that no tools, testing gear or handlamps are left in or about the transmitting plant.

(b) After a transmitter has closed down, the engineer responsible for its operation must see that all items of starting control gear are in the off position and that the circuit-breakers or switches controlling mains supplies are open.

(c) Maintenance work on equipment involving risk of contact with conductors that are live or may in any circumstances be live may only be undertaken as laid down in the Regulations under 2.4.1, and a second member of staff must be in a position to render immediate assistance should the need arise while such work is in progress.

(d) Before any maintenance or repair work is done on plant at non-attended or semi-attended transmitting stations the remote circuits must be made inoperative.

2.7.2 Plant Enclosures and Cubicles (see Section 3.8.2)

(a) The gates or doors of any plant enclosure or cubicle must not be closed while any person is inside, unless he is under the direct instructions of the senior engineer on duty, who must take stringent precautions to ensure that the equipment remains isolated from all supplies. The senior engineer on duty is responsible for ensuring that no exception is made to this Regulation in any circumstances whatsoever.

(b) Where a red/green safety lamp system is provided to indicate whether auxiliary circuits within an enclosure are live or dead (see 3.8.2), any covers that may have been provided as a protection against contact with live terminals must be left in place when any maintenance work has been completed. When replacements are made in the indication system, care must be taken to ensure that the correct colour of lamp or glass is used and the system must be checked by the senior engineer on duty after the replacement has been made.

(c) Where plant enclosures or cubicles are not interlocked but have gates, doors or panels provided with locks or padlocks, these may be unlocked only by a responsible person acting under the direct instructions of the senior engineer on duty. Particular care must be taken about any auxiliary circuits that may remain live after the main equipment has been isolated. The gates, doors or panels must be closed again immediately the maintenance or other work is completed. (See Regulation 2.3.7(b).)

(d) Where panels of enclosures or cubicles are normally held in position by screws or bolts, these must not be removed except by a responsible person acting under the direct instructions of the senior engineer on duty.

(e) Adequate precautions must be taken to ensure that the power supplies have been disconnected before panels are removed, and that there is no possible danger of the supplies being inadvertently re-applied.

(f) Dangerous r.f. voltages may be present even when the power supplies to the unit have been disconnected, for example, on medium-frequency transmitters. Care must be taken that such voltages have been removed before the circuits are exposed.

(g) Where interlocked enclosures contain main and auxiliary equipment and only the main equipment is rendered dead by the operation of the interlocking arrangements, Regulation 2.7.1(c) must be observed.

(h) Gates or doors of the interlocked enclosures or cubicles, and isolators of auxiliary circuits, may not be re-closed after inspection or maintenance work is completed except by the person responsible for the operation of the equipment.

(j) Staff not regarded by the senior engineer on duty as fully competent to work without supervision in an enclosure or cubicle containing live auxiliary equipment must not be permitted to enter the enclosure or cubicle unless accompanied by, and acting under the supervision of, the senior engineer on duty or a responsible person delegated by him.

(k) While an authorized person is within an interlocked enclosure or cubicle containing live auxiliary equipment or exposed terminals, another member of the BBC staff must remain in the area and be able to render immediate assistance in case of need.

(l) Doors of switchrooms and substations which are remote from the main buildings at transmitting stations are to be kept locked except for entry by staff acting under the instructions of the senior engineer on duty.

(m) Doors of high-voltage and medium-voltage switchrooms in main buildings of transmitting stations need not be locked, and must not be locked whenever presonnel are working in these areas.

2.7.3 Covers of Tanks, Sumps and Cable Ducts

Covers of tanks, sumps, cable ducts etc. must be kept in position except when removal is necessary for inspection purposes. (See also Regulation 2.3.19.)

2.7.4 Electrical Storms (see also Regulations 2.4.17 and 2.8.6)

(a) Should there be a serious electrical storm in the immediate vicinity of a transmitting station where transmitters are working, and in the opinion of the Engineer-in-Charge or his deputy there is appreciable risk of danger to staff or damage to plant from lightning, the Engineer-in-Charge or his deputy must arrange for the transmitters to be shut down until the storm centre has passed away from the vicinity.

(b) If damage from lightning has occurred, staff must not touch the damaged equipment until the storm has left the vicinity and the equipment has been discharged to earth.

(c) At certain transmitting stations where the electrical conductivity of the soil is low, a high voltage may be set up on service cables leading into the building while thunderstorms are in the vicinity. At such times staff must avoid handling any metalwork, including U-links, connected to lines entering the building and must also avoid handling telephone handsets. The Engineers-in-Charge of the stations concerned have been instructed to inform their staff of the risk.

2.7.5 *Interlock Systems* (see also Regulation 2.4.1(c))

(a) All interlocking arrangements must be tested in accordance with the Transmitter Group Standing Instructions and the records of such tests maintained and the reports issued as laid down in those Instructions.

(b) If a fault in an interlock or protective system renders it ineffective, the plant must be closed down until the fault is remedied. In exceptional circumstances, and where the repair work would entail the closing down of a transmitter for a lengthy period, the transmitter may be re-started with the interlock or protective system out of circuit, provided that:

- (i) Special authority is first obtained from the Engineer-in-Charge or his deputy.
- (ii) The Superintendent Engineer concerned is informed as soon as possible.
- (iii) Danger notices are placed at appropriate parts of the plant.

2.7.6 *Smoothing Circuits* (see Section 3.8.3)

(a) The main high-voltage d.c. cables may not be disconnected from rectifiers or d.c. generators for testing purposes or, where mercury arc rectifiers are concerned, for high-tension bake-out or other work until the power has been removed and the transmitter earthing switch has been closed. Notices must be placed on the switches, forbidding any person to operate them without the direct authority of the senior engineer on duty.

(b) With transmitters where earthing switches are not interlocked with gate mechanisms of smoothing enclosures it is essential that earthing switches should be closed manually before any part of the smoothing equipment is touched.

2.7.7 *High-voltage Mica, Paper and Oil-filled Capacitors* (see Section 3.8.4)

(a) Capacitors may not be touched until they have been discharged by an earthing wand of the approved type.

(b) Mica and paper capacitors which have been removed from circuit must be kept in a short-circuited condition by means of stout copper conductors. The short-circuiting conductor may not be removed from a capacitor until the latter is again required for service.

(c) Oil-dielectric and oil-filled mica capacitors must be maintained at the oil levels specified in local instructions.

2.7.8 *Earthing Wands* (see Section 3.8.5)

(a) Earthing wands are provided for earthing equipment in the specific circumstances described below, **and their use for any other purpose is prohibited:**

(i) On an anode, grid or cathode circuit of a transmitter unit after it has been isolated from the supply, to ensure that it cannot be made live.

(ii) To ensure that capacitors, already isolated, are discharged.

(iii) To ensure that r.f. circuits, during wave-change, fault or maintenance periods are not inadvertently re-powered and are not carrying r.f. voltage induced from other transmitters on the site. (See Section 3.9.2.)

(b) All earthing wands must be permanently connected by heavy dynamo flex to earth at some point convenient to where they will be used.

2.7.9 Commutator-grinding on High-voltage Motor-generators

(a) Safety precautions must be supervised by the Engineer-in-Charge. The actual work will be performed by experienced staff under skilled supervision.

(b) The motor isolator switch must be opened before beginning the preliminary operations, which include:

- (i) the closing of the earthing switch on the high-voltage side of the generator;
- (ii) disconnection of the field supply to the high-voltage generator at the field terminals;
- (iii) taping of the field supply leads;
- (iv) setting up of the commutator grinder.

(c) Danger notices must be hung on the motor starter, the generator selector switch and the high-voltage d.c. panel.

(d) When these operations are completed, and subject to the agreement of the Supervising Engineer, the motor starter isolator may be closed and the motor energized in order to rotate the armature for the grinding operation.

2.7.10 Handling of Klystrons and Semiconductors

(see also Regulation 2.3.26 and Section 3.8.6)

(a) No work may be carried out on a klystron by staff who have cuts or abrasions on the hands.

(b) The ceramics must be cleaned only with approved materials.

(c) Broken ceramics must be handled with extreme care and Valve Section must be advised so that collection can be arranged.

(d) All expended klystron and semiconductors must be returned to Valve Section for disposal.

2.8 Masts, Aerials and Aerial Feeders

Though the Regulations in this Section on masts, aerials and aerial feeders apply particularly to Transmitting Stations, they must also be observed by staff working at any place on temporary or permanent structures of this kind and any special local regulations must also be observed.

Note: The word 'ascend' includes both climbing and going up by lift.

2.8.1 Masts (see Section 3.9.1)

(a) No person may ascend any mast without the authority of the Engineer-in-Charge or his deputy and this authority may be given only to persons who require to make an ascent for inspection, installation, repair or other essential purpose. Where work on the mast is being done under the direct supervision of a specialist engineer, the requisite authority for ascent of the mast must be obtained from him. Authority will not be given unless the mast is earthed at the base (see Regulation 2.8.1(j)). If an aerial supported by, or in the neighbourhood of, the mast is radiating, authority will not be given unless it has been ascertained that there is no risk of shock or burns; even a slight shock that would be harmless on the ground might cause a person on the mast to fall.

Safety belts or harness of a type approved for the kind of work in hand must be worn by all BBC employees ascending masts and must be securely anchored, not only during working periods but also during rest pauses in the ascent or descent. The anchorage to the mast structure must be made by means of the correct accessories supplied with the climbing harness, and must be kept as short as possible. Where a greater degree of freedom is required an inertia reel safety block of the approved type must be used, anchored above the user's head and attached directly to the harness.

(b) Persons working on masts must be informed before work begins of the duration of their permit. A record must be made in the relevant log-book.

(c) No person shall be permitted to ascend a mast if he is known to suffer or to have suffered from epilepsy or any other physical weakness that might endanger his safety.

(d) No person shall be permitted to ascend a mast if he feels unwell.

(e) No BBC employee shall, under any circumstances, be required to ascend a mast against his will.

(f) Except in circumstances of extreme urgency, masts may not be ascended during a high wind, or when the mast structure is covered in ice.

(g) Before a mast is ascended, if there is any risk of contact with live conductors, all such conductors must be isolated under the supervision of the senior engineer on duty.

(h) If locking facilities are provided with isolators and these isolators are locked in the open position, the keys must remain in charge of the person ascending the mast until the work is completed.

(j) Masts which are insulated at the base must be earthed before any ascent is made, or any ladders are placed against them. Danger notices must be secured to the earthing switches.

(k) It is the responsibility of the BBC Building Department to ensure that permanent masts and all associated equipment, including lifts if any, are maintained in safe condition. The Engineer-in-Charge must make regular reports, in a prescribed form, of the condition of all such equipment, and must also call the attention of Building Department immediately to any faults observed.

(l) The greatest care must be taken to avoid the dropping of tools by persons working on masts or other high structures. When climbing is being done, tools must be fastened to the body.

(m) While work is being done on a mast, open ground around the mast to a radius of at least 50 feet must be regarded as a dangerous zone.

(n) When work is being done on masts or other high structures, warning notices must be in position in the dangerous ground area below.

(o) Hand lamps may be used only in accordance with Regulation 2.4.7(f).

(p) The use of contractors' erection winches and cradles and the Corporation's maintenance winches and halyards for the conveyance of staff is expressly forbidden unless:

(i) Head of Building Department has agreed to the use of the particular equipment for this purpose;

(ii) permission has been obtained from the Superintendent Engineer or Head of Department responsible for the equipment and also from the Superintendent Engineer or Head of Department responsible for the staff making the ascent;

(iii) the staff concerned have volunteered to make the ascent;

(iv) the operation is conducted under the supervision of a senior engineer who has decided that weather conditions are suitable but does not, except in an emergency, take any part in the operation;

- (v) the winch drivers, whether employed by the Corporation or the contractor, are, in the opinion of the senior engineer referred to under (iv) above, adequately trained and competent to operate the winch for this purpose and remain in attendance to control the gear throughout the entire operation and until the staff are lowered to the ground.

(q) Work carried out by contractors is permitted only within terms specifically issued at the time by

- (i) the Superintendent Engineer,
- (ii) Head of Transmitter Planning and Installation Department through the Superintendent Engineer or
- (iii) Head of Building Department through the Superintendent Engineer.

(r) Contractors' employees must not be allowed to work on masts unless supervised by a member of BBC staff designated by the Engineer-in-Charge, who must ensure that the Regulations under 2.8.7 are observed. The contractors' employees must be accompanied by the designated member of BBC staff when work is being carried out on masts carrying live aerials.

2.8.2 Masts and Aerials: Erecting, Dismantling and Rigging (see Section 3.9.2)

(a) The Regulations under 2.8.1 apply in addition to the following.

(b) The senior BBC engineer supervising the job (who must be named on each occasion) is responsible for the safety of personnel except when the job is being done by a contractor who will be required to take full responsibility for the execution of the work and for injuries which may be sustained by his employees.

(c) For requests from contractors for BBC staff to assist them, see Regulation 1.9.5.

(d) Engineers supervising mast erecting, dismantling or rigging work must give first consideration to the safety of personnel and must not permit risks to be taken in order to save time. Work must not be allowed to continue when poor conditions, such as bad weather or poor light, make it unsafe.

(e) Halyards, sheave blocks, rigging screws, bo's'n's chairs, lifting tackle etc. used by BBC employees must be inspected before use by the BBC engineer supervising the job, or by an experienced rigger delegated by this engineer to ensure that such equipment is suitable for the purpose and, so far as can reasonably be ascertained, that it is in good condition.

(f) Except when work is done by contract, no mast shall be erected or dismantled except under the constant supervision and inspection of an experienced BBC rigger, who shall act as foreman of the operation. Under the orders of the senior BBC engineer responsible for the job, the rigger shall take full responsibility for ensuring at all stages of the work, that:

(i) stay-ropes, temporary stays, check ropes etc. are properly secured;

(ii) lifting tackle is sound and functioning satisfactorily;

(iii) stay adjusters, such as bottle screws, carpenters' stoppers, links etc., are properly set;

(iv) anchorages are solid.

In addition, the BBC engineer or the rigger shall satisfy himself by personal inspection that all fastenings such as shackles, bulldog grips, clamps, etc. are securely made before any load is applied. Particular attention must be given to the latter points when casual or inexperienced labour has been employed on the job.

It must be borne in mind that tubular steel masts and other structures may be weakened by internal corrosion and the danger of collapse must be guarded against by keeping staff at a safe distance during raising and lowering operations.

(g) No BBC employee shall ascend any part of a mast, derrick structure or associated erection-spars (permanent or temporary), unless its erection has been supervised by an experienced rigger, who has satisfied himself that:

(i) the structure is sufficiently strong and rigid for safe ascent, and

(ii) all stays, anchorages and fastenings are satisfactorily secured.

(h) In no circumstances shall any person be permitted to climb any type of mast, derrick or other structure which is designed to be erected in its assembled state, whilst it is in the process of being raised or lowered. Such a structure must be fully erected and secured before any climbing is done.

2.8.3 Aerials and Aerial Feeders (see Section 3.9.2)

(a) Staff must take particular care not to come into contact with live aerial downleads or r.f. feeders which cross sites or roofs of buildings. Danger notices must be exhibited at points where danger is likely to arise.

(b) Before work is done on any part of a feeder system, the system must be connected to an earth spike driven into the ground; the connecting cable must be as short as possible.

(c) An aerial must be solidly earthed before it is disconnected from its associated apparatus and before any work is done on it.

(d) Conditions may differ widely at different zones of a transmitting site and at different times. Local regulations defining where and when work is permitted must be observed.

2.8.4 Short-wave Aerials and Aerial Arrays

(a) The Regulations under 2.8.3 apply in addition to the following.

(b) At short-wave transmitting stations where there are no key interlock systems associated with the array feeders, tally systems must be used. No array may be powered unless the appropriate tally is hung on the tally board.

(c) No work may be done on an array or its associated feeder until power has been removed from the array and the appropriate tally has been taken from the board after the permission of the senior engineer on duty has been obtained for its removal.

(d) At short-wave transmitting stations where there are key interlock systems, the appropriate key must be handed by the senior engineer on duty to the senior member of the staff instructed to work on the aerial array or its associated feeder (see Section 3.9.3).

(e) The tally or interlock key must be returned to the senior engineer on duty only when the work is completed and it is safe to power the array.

(f) Appropriate entries, with signatures, covering the movements of tallies or interlock keys, must be made in the log books provided.

(g) If there is any danger to staff working on one array or its associated feeder because of radio-frequency pick-up from a neighbouring array, the tallies or interlock keys of both arrays must be removed while the work is being done.

2.8.5 Aerial Tuning Huts and Rooms Containing Aerial or Feeder Switching or Matching Equipment

(a) Buildings or rooms containing aerial or feeder switching, tuning or matching equipment, if not fitted with an interlock system, must be kept locked and no person may be permitted to enter unless it is part of his normal duties to do so, or he has received the authority of the senior engineer on duty.

(b) If the room entrance is through a transmitter unit, the gate or door of the transmitter must be locked in an open position before entrance is made, the key remaining in charge of the person doing the work.

(c) In special cases involving the checking of adjustments in an aerial tuning hut, it may be necessary to apply power before adjusting work can be regarded as completed and while staff are still in the area concerned. In such circumstances the following precautions must be observed:

  (i) Telephonic communication must be continuously maintained between the test point and the transmitter control point.

  (ii) Power must not be applied unless information has been received from the test point that it is safe to do so.

(iii) Before power is applied on any occasion, the person at the test point must be informed that power is coming on.

(iv) Entries must be made in the transmitter log book, recording the operations at the central point, and signed by the senior engineer on duty.

2.8.6 Electrical Storms (see also Regulations under 2.7.4)

No work may be carried out during electrical storms on aerials, aerial arrays, feeder lines or aerial tuning hut equipment which would expose staff to danger from static charges.

2.8.7 VHF and UHF Aerials at Transmitting Stations (see also Regulation under 2.4.14)

(a) A tally system must be maintained to ensure the safety of persons climbing or working on the masts or associated equipments supported thereon.

(b) The tally system must be operated in accordance with local regulations approved by the Superintendent Engineer, which will also impose restrictions on access to masts and associated equipments while any part is powered.

(c) Climbing within mast sections on which energized aerials are mounted may be done only if:

(i) the Regulations under 2.4.14 are observed,

(ii) staff use the ladder provided and

(iii) live feeders or aerial parts capable of giving a shock or burn are either inaccessible from the approved climbing position or are suitably screened.

(d) No rigging work of any description external to the mast structure may be carried out unless a clearance of at least 10 feet can be ensured at all times between a live element and both staff and materials.

(e) Work on the unpowered half of a split system must be restricted to essential maintenance and may at all times be permitted only under the continuous supervision of a responsible engineer designated by the Engineer-in-Charge or Head of Department.

2.8.8 Extending Towers and Masts

(a) Before any extending tower or mast is erected, the voltage of any overhead electricity supply lines in the vicinity must be ascertained.

(b) The tower or mast must not be erected within a distance equal to its fully extended height plus 20 feet from a medium-voltage or high-voltage overhead power supply line, and must not be erected in such a position that the clearance between any part of the tower, mast and stays and any low-voltage supply line, telephone line or overhead wires or other obstruction is less than 10 feet. This minimum clearance must be observed at all stages of erection.

The mast must be erected only at a point designated by the Supervising Engineer and conforming with the requirements mentioned above.

(c) The erection of the tower or mast must be carried out in accordance with detailed instructions issued by the department responsible for its operation and the Regulations under 2.4.6 dealing with the fusing and earthing of equipment must be observed.

(d) Extending towers must be erected on firm and reasonably level ground and stayed if there is a risk of high winds or if the mast is to remain extended while unattended.

(e) Regulations 2.8.1(a), (c), (d), (e), (f), (k), (m), (n) must be observed, but in 2.1(a) the reference to the Engineer-in-Charge would apply to the Senior Communications Engineer on Duty.

(f) While work is being done on an extending tower or mast, the area around it to a radius of at least 20 feet must be regarded as a dangerous zone.

(g) Under no circumstances may staff climb an Eagle Tower above the 30-foot level.

(h) While staff are working on an extending tower or mast the Senior Communications Engineer on Duty must make frequent checks to ensure that they are safe.

2.8.9 Shared Masts

On stations shared with other authorities, e.g. the I.T.A., any additional local safety requirements will be the subject of local instructions.

CHAPTER 3

GENERAL INFORMATION AND RECOMMENDATIONS

3.1 Comments on the General Regulations

3.1.1 Introduction (see Regulation 1.1)

Supervising Engineers, as defined in Regulation 1.6, are responsible for ensuring that staff who are required to undertake work involving danger possess adequate technical knowledge and experience to avoid such danger, and for ensuring that the staff under their charge understand and observe those parts of the Safety Regulations that concern the work they are required to do.

3.1.2 Contractors' Employees

(a) Special Regulations apply in television studio grid areas and in other television technical areas. In these areas the provisions of Regulations 2.6.1 must be complied with. (Regulation 1.9.1.)

(b) The BBC is not responsible for the actions of contractors' employees working on plant that has not been taken over by the BBC, or on plant that has been handed back to the contractors.

(c) Where work is done under the normal contracts administered by the Building or Planning and Installation Departments, it is the general practice that contractors are required to provide their own tools and appliances for the conduct of the work, and this practice should be adhered to where smaller works are commissioned by the Engineer-in-Charge. In special circumstances the contractors may be allowed to borrow BBC tools and appliances as an act of favour provided that the Engineer-in-Charge or other person approving the loan takes reasonable precautions to ensure that the article is in good condition and is safe to use when handed to the contractor and also when returned by him. (Regulation 1.9.3.)

(d) Permission should not be given to contractors' employees to operate cranes or hoists forming part of BBC equipment unless the BBC senior engineer on duty is satisfied that the contractors' employees understand the hazards that may arise from possible contact between hanging loads and adjacent switchboards or other electrical equipment, and unless such cranes etc. have been inspected within the previous six months by the Corporation's Insurance Plant Inspector. (Regulation 1.9.4.)

3.1.3 Danger Notices (see Regulations under 1.10)

'Plant acceptance and safety precaution procedure' is the procedure which must be carried out in demonstrating the operation of the equipment to an authorized representative of the Operations and Maintenance Department before the acceptance of the equipment by that Department (Regulation 1.10.4.)

3.2 Fire Precautions (see Regulations 2.1)

3.2.1 Introduction

The regulations for fire procedure vary from building to building throughout the BBC. Local Authority regulations and the availability of the local fire-brigade differ; furthermore the varying nature of the work carried on demands local variants. Knowledge of local arrangements and compliance with them is, therefore, of the utmost importance.

Some advice, however, which will be applicable in almost every case, is given in the following sections.

3.2.2 Duties of Staff

Engineers-in-Charge should nominate staff who have specific duties in the event of fire, such as electricians whose duties would include switching off non-essential supplies, a team of fire-fighters if there is no official team of firemen, and staff to take a roll-call when buildings are evacuated.

3.2.3 Recommended Action in a Fire

(a) If you have to evacuate a building, close all windows and doors of your room but do not lock them. Switch off electrical and gas apparatus in the room. Then leave in an orderly manner by your nearest escape route. Never use a lift as a means of escape.

(b) If you must use a staircase which you suspect may be weakened by fire, keep close to the wall when using it.

(c) If you suspect a fire on the other side of a door which you must use, open the door slowly, shielding yourself as much as possible.

(d) In rooms already filled with smoke, walk in a bent position or crawl; there is usually breathable air near the floor and vision is better. It may be helpful to have a wet cloth or handkerchief covering the mouth and nose.

(e) Do not allow people with burning clothes to run about. Wrap them in rugs, coats or sheets, lay them on the ground and, if necessary, roll them about to extinguish the flames.

3.2.4 Use of Particular Types of Fire Appliance

(a) Water-type Extinguishers and Pumps

Use: On fires of ordinary combustible materials, e.g. woodwork, paper, carpets, rubbish etc.

Method: Direct the jet at the base of the flames and work as close as possible to the fire.

Warning: Water-type extinguishers and pumps must not be used on live electrical equipment or on fires involving oil, paints, fats etc.

(b) Foam-type Extinguishers

Use: On all fires involving flammable liquids.

Method: Cover the surface of the burning liquid with foam. If the liquid is contained in a pan or tank, the jet must be directed on to the side of the container so that the foam flows down on to the burning liquid without stirring it up. If the burning liquid is flowing freely on the ground, the extinguisher should be kept at such a range that the foam falls vertically on to the liquid.

Warning: Foam-type extinguishers must not be used on live electrical equipment.

(c) Carbon-dioxide Extinguishers

Use: On all small petrol fires or fires involving live electrical equipment. Particularly suitable for use on delicate electrical apparatus.

Method: Direct the extinguisher at the base of the flames. Work as close as possible to the fire.

Warning: If the extinguisher has been used in a confined space, staff should not enter the area until it has been thoroughly ventilated.

(d) Dry-powder Extinguishers and Sand in Buckets

Use: On all fires involving flammable liquids; on all electric wiring.

Method: Attempt to obtain a limited effect by smothering and absorbing. Follow by using the appropriate extinguisher as soon as possible.

Warning: Sand should not be used on delicate electrical apparatus or on motors if a more suitable extinguisher is available.

e) Fire Blankets

Use: Whenever an immediate smothering effect on blazing material or personal clothing is required.

Method: For blazing clothing on a person, attempt to smother the flames by wrapping the blanket around the person.

(f) Carbon-tetrachloride (C.T.C.) Extinguishers

Use: On all small petrol fires or fires involving live electrical equipment.

Method: Direct the jet at the base of the flames so that the liquid will vaporize quickly and form a layer of gas.

Warning: Carbon-tetrachloride, when used on a fire, can give off a highly toxic gas (phosgene) and therefore must not be used in confined spaces where immediate ventilation,

after the fire is put out, is impossible. For this reason the provision of new C.T.C. extinguishers, except in vehicles, has been discontinued and existing extinguishers of this type will be replaced as opportunity offers.

(g) Methyl-bromide Extinguishers

Because of the highly toxic nature of this substance, its use is now prohibited except where a particular station has an existing automatic installation. If a fire occurs to bring such an installation into use, it is especially important to comply with Regulation 2.1.3.

Such methyl-bromide installations will be replaced if they are in areas where staff are likely to be working.

3.2.5 Location of Fire Extinguishers

Fire extinguishers must be kept in accessible positions but not so close to the apparatus they are designed to protect as to create a risk that they might become inaccessible if the apparatus catches fire. In particular:

(a) Foam-making machines must not be placed under a platform on which oil tanks are mounted.

(b) Extinguishers for use in switchrooms must not be placed close to the switchgear. Where entrances to switchrooms are inside buildings, and local conditions permit, the fire extinguishers must be placed just outside these entrances. Where access to switchrooms is direct from the open air, the fire extinguishers must be placed just inside the switchroom entrances.

3.2.6 Oil Fires

It is essential to take quick action with oil fires to prevent extensive damage. Water must not be used except where equipment giving a fine spray of water has been specially installed for the purpose, and there are no live electrical conductors present (see 3.2.7 for live conductors).

Small oil fires can be effectively extinguished by use of the hand appliances provided or by throwing sand, or even cement, on them. Extensive oil fires due to the ignition of fuel oil or oil from transformers are best dealt with by using the foam-making machines provided or auxiliary fire-pump appliances with foam-making branch pipes.

3.2.7 Fires involving Live Electrical Conductors

Only Carbon-dioxide-type extinguishers (or C.T.C. extinguishers where they have not been replaced) may be used on or near live electrical conductors. Extinguishers of other types should be marked so as to prohibit such use, though they may be used on consequential fires after all electrical circuits have been made dead.

Warning: The contents of most fire extinguishers, other than carbon-dioxide and C.T.C. types are highly conductive and their indiscriminate use would involve serious risk of electric shock.

3.2.8 Ventilation after Extinction of Fire

The importance of thorough ventilation in any area in which a fire has been extinguished is emphasized, especially where a discharge of C.T.C., Methyl-bromide or CO_2 fire extinguishers has taken place. (Regulation 2.1.3.)

The gases liberated on the discharge of fire extinguishers containing these chemicals are dangerous to life. Methyl-bromide, even in small concentrations, is toxic and CO_2 can cause suffocation. C.T.C. is also dangerous because when it is used on a fire, phosgene can be generated.

The products of combustion also, especially in electrical fires, are likely to contain toxic gases.

3.2.9 Respirators

Civilian, Civilian Duty or Service-type respirators provide no protection whatever against the gases liberated by the discharge of fire extinguishers or generated by combustion, and must therefore not be used.

3.2.10 Spontaneous Combustion

Spontaneous combustion may occur in cotton waste and other similar material when impregnated with oil, and also in contaminated steel wool. These materials, therefore, should be kept in fire-proof containers pending safe disposal.

3.2.11 Fires resulting from Faults in Electrical Circuits

Regular routine inspection of all electrical heating and lighting fittings can do much to prevent fires. Particular points to look for are:—

Defective contacts (due to arcing)
Loose terminals
Loose clippings of wire in switch-boxes etc.
Perished flex
Earth sockets on 3-pin sockets not properly earthed
Inefficient earthing of metal-clad equipment
Inadequate sizes of cable to fuse-boxes and power-sockets
Cut-away fabrics extending into switch-boxes or connection-boxes, switches etc., fitted on fabric-covered walls
Dust, oily rags and other combustible deposits on or near equipment

Examination for these defects must be carried out with proper precautions, e.g., fuses should be withdrawn and if necessary examination carried out with the aid of an electric torch.

3.2.12 Blowlamps

Filling and lighting blowlamps or similar appliances should always be carried out with great care so that there may be no chance of accidental ignition of the fuel, and an extinguisher suitable for fires involving flammable liquids should be kept readily available in areas where these appliances are in use.

3.3 Accidents and First Aid

3.3.1 First-aid Boxes (see Regulation 2.2.3)

(a) Where factory areas and office areas are in the same premises the number of qualified first-aiders required to comply with the Factories Act and the Offices Act can be based on the maximum number of staff present at any one time in the factory areas and the office areas taken together. A reasonable basis is to take the number of persons employed at any one time in the factory areas, plus one-third of those employed at the same time in the office areas and then to apply the requirements of Section 61 of the Factories Act to the whole of the premises. This means that when the total obtained in this way exceeds 50 a qualified first-aider must be available.

(b) In view of the fact that different people may at different times be responsible for any one box, it may be more convenient to refer to the responsible person by his designation (e.g. Foreman or Supervisor) rather than by name, provided that all the persons so described have the necessary qualifications and one or other of them is present at all material times.

(c) The inclusion of sulphacetamide eye ointment in the first-aid boxes is required by law, but if hospital treatment is readily available it is preferable merely to cover an injured eye with an eye pad and get the victim to hospital without attempting to insert the ointment, except as provided under 3.3.7.

3.3.2 Neutralizing Agents for Corrosive Substances: Acids or Alkalis

The neutralizing agents for acids and alkalis are different and the greatest care must normally be taken to use the correct agent, but the Buffer Solution provided will neutralize either acid or alkali. This solution is supplied in standard 500-ml bottles, and except where other arrangements exist should be obtained from Messrs. John Bell & Croyden, 50 Wigmore Street, LONDON W.1, through normal local purchase arrangements. The order should specify 'Standard Buffer Solution to BBC requirements: Dispensing Reference AF 4297'.

Warning: A bottle of Buffer Solution must in no circumstances be opened until it is going to be used. The solution and bottle are supplied in a sterile condition, but opening may allow germs to grow which could cause infection when the liquid is applied. A sterile unopened bottle must be obtained immediately to replace any bottle opened. A slight brown sediment at the bottom of an unopened bottle is not abnormal, and the solution should keep indefinitely if unopened.

3.3.3 First-aid Treatment for Acid or Alkali Burns

(a) Eyes

- (i) Douche well with cold water
- (ii) Wash a number of times with Buffer Solution in an eye-bath, changing the solution frequently.
- (iii) Cover the eye with a cold wet bandage and make urgent arrangements for nursing, medical or hospital attention.

Warning: Eye-baths are difficult to sterilize adequately, consequently great care must be taken in the sterilization process, otherwise their use may spread infection.

(b) Other parts of the body

- (i) Douche well with cold water
- (ii) Wash thoroughly with Buffer Solution
- (iii) Cover with sterilized dressing and arrange for nursing, medical or hospital attention.

3.3.4 Accidents with Battery Electrolyte

The treatment is as described in 3.3.3, but the special Buffer Solution must be kept available wherever batteries with free liquid electrolyte are likely to be encountered. It should be kept at the point of maximum danger, so that a victim of this kind of accident can reach it with minimum difficulty and loss of time.

3.3.5 Accidents with Colour-film Processing Chemicals or other potentially dangerous Liquids

Douche copiously the effected parts with cold water. If there appears to be any risk of burning, cover with a sterilized dressing and arrange for nursing, medical or hospital attention.

Warning: Some processing chemicals contain poisons, such as cyanide.

3.3.6 Minor Injuries: Cuts, Abrasions etc.

Treat immediately to avoid infection. Do not wash the wound, but cover with a prepared dressing from the first-aid box and bind up. Do not touch the wound or the part of the dressing which is placed directly over the injury. In all cases of doubt, arrange for nursing, medical or hospital attention.

3.3.7 Eye Injuries

(a) For acid and alkali burns as in 3.3.3.

(b) For splashes in the eye of liquids such as carbon tetrachloride or Servisol, or when the composition of the liquid is not known:

  (i) Douche well with cold water

  (ii) Cover the eye with a cold wet bandage and arrange for nursing, medical or hospital attention.

(c) For splashes in the eye of Colosyl 66 solution:

(i) Apply immediately olive oil, liquid paraffin or some other bland oil

(ii) Arrange for nursing, medical or hospital attention.

Note: A person splashed in the eye with Colosyl 66 solution would be in no actual danger without treatment, but the eye movements might produce discomfort for a time.

(d) For other eye injuries, cover the eye with a sterilized dressing as soon as possible and send the person concerned to a doctor or a hospital, whichever is the quicker. If there are foreign bodies in the eye, do not attempt to remove them but apply a little Factory Act eye ointment before sending the person to the doctor or hospital.

3.3.8 Ordinary Burns and Scalds

Do not apply grease and do not open any blisters. Cover the burn or scald immediately with a sterilized dressing. Do not touch the injured skin or that part of the dressing which will come into contact with it. Arrange for nursing, medical or hospital attention.

3.3.9 Cuts from Glass, e.g. of Fluorescent Tubes

Treat as in Section 3.3.6, but if the cut is of more than minor nature, or if there is any possibility that glass remains in the wound, arrange for nursing, medical or hospital attention.

3.3.10 Electric Shock

Cards giving instruction on methods of resuscitation from electric shock are displayed in all areas containing electrical plant. In no circumstances may these cards be removed, defaced or obscured.

If a victim of low-voltage shock is still in contact with a live conductor, the supply must be switched off before the body is touched, but only if it is possible to do the switching off quickly. If it cannot be done quickly owing to inability to operate the switchgear, the body must be carefully worked clear by means of some non-conducting **dry** material, such as a dry length of wood (e.g. a broom-handle).

If the victim is in contact with a high-voltage conductor, the supply **must** be cut off before any attempt at rescue is made.

Warning: Any attempt to touch the body while it is still in contact with a live conductor may cause serious (perhaps fatal) injury to the person rendering assistance.

Great care must be taken in removing the victim to ensure that his bare skin (hands, face etc.) does not again come into contact with a live conductor.

To enable the medical attendant to assess the treatment required, all the circumstances in which the shock was received should be reported.

Especially important are:

(a) nature of the source of shock,

(b) path of the discharge through the body, e.g. hand-to-foot, hand-to-hand etc. and

(c) the precise time at which the shock occurred.

Cases of electric shock should always be reported to Surgery, irrespective of the wishes of the patient.

3.3.11 Artificial Respiration

It is the responsibility of the Engineer-in-Charge to ensure that instruction cards on artificial respiration are displayed in areas where there is any special risk of electric shock. Staff working in such areas must make themselves completely familiar with the instructions given so that, should the need arise, they may be able to give prompt and correct aid. (See Paragraph 14 of the *Safety Rules in Brief*.)

In the first instance the 'mouth-to-mouth' or 'kiss of life' method should be used, according to the instructions shown in the illustrations on the opposite page. If the person applying the treatment becomes too tired or for some reason the mouth-to-mouth method cannot be used, then the Porton resuscitator should be used; such apparatus can also be useful in other emergencies such as heart attacks, severe asthma or bronchitis. The patient should be kept warm and not moved until expert attention is available.

Staff must make themselves aware of the position of available equipment for resuscitation, e.g. oxygen and Porton devices, and must be familiar with their use.

3.3.12 Burns accompanying severe Electric Shock

Where a severe shock is experienced there is usually some superficial burn. If the skin is burnt through or charred, use immediately the dressing for the burn from the first-aid box. Should this not be available, exclude air from the burn by covering with gauze. Do not administer stimulants except on the instructions of a doctor. Remember that electrical burns are always worse than they appear to be at first.

Treatment for

ELECTRIC SHOCK

MOUTH-TO-MOUTH METHOD

Lay casualty on back; if immediately possible, on a bench or table. Place folded coat under shoulders to let head fall back.

Fig. 1. Kneel or stand by casualty's head. Press his head fully back with one hand and pull chin up with the other.

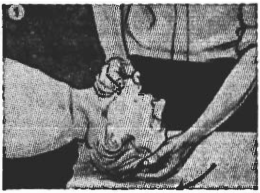


Fig. 2. Breathe in deeply. Bend down, lips apart, and cover casualty's mouth with your open mouth. Pinch his nostrils with one hand. Breathe out steadily into casualty's lungs. Watch his chest rise.

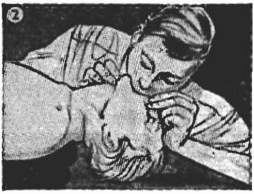
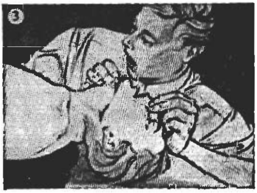


Fig. 3. Turn your own head away. Breathe in again.



Repeat 10 to 12 times per minute.

If you have difficulty in blowing your breath into the casualty's lungs, press his head further back and pull chin further up. If you still have difficulty, check that his lips are slightly open and that the mouth is not blocked, for example, by dentures.

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3.3.13 Rescue from Medium- and Low-voltage Shock

The results of certain practical experience suggest the possibility of self-rescue from electric shock. Immediate action is essential and self-rescue, if possible at all, might well be quicker than relying on outside help. The principle danger with low voltage, and possibly medium voltage, is that the victim is unable to let go. Since the effect of the shock depends on its duration, it is necessary to find some quick method of release.

Methods that have been found effective include:

(a) Interrupting the supply, using a piece of insulating material if necessary.

(b) Increasing the resistance by, for instance, moving the feet or jumping in the air and resisting the natural impulse to concentrate all efforts on unclenching the affected hand.

(c) Getting the body into a position in which the current flows through a limb rather than through the heart and, if possible, pressing the live conductor to the floor.

(d) Where the shock is produced by a voltage gradient, keeping all parts of the body as close together as possible.

(e) Reducing the current by standing on tip-toe or on the heels, provided the shoes are dry.

Where the current to earth is passing through the feet, the most promising method is to try to jump in the air and release the hand at the same time.

If, but only if, the shock is caused by a low-voltage source, it might be advisable to reduce the voltage by trying to bring the live and neutral (or earth) conductors into contact.

3.4 Mechanical, Chemical and other Non-electrical Hazards

3.4.1 Portable Ladders (see Regulations under 2.3.1)

It should be clear that one of the most important points in the erection of ladders is that they should be firmly placed so as to avoid the possibility of slipping; the assistance of a second person at the bottom of a tall ladder is recommended, to keep it steady.

The safest angle between ladder and floor is 60—70 degrees.

3.4.2 Machines and Machine Tools (see Regulations under 2.3.3)

For many types of machines, including hand-operated slicing machines, potato chipping machines, platen printing machines and guillotine machines, the Regulations under this head are statutorily imposed under the Offices, Shops and Railway Premises Act 1963, under the Factories Act 1961 and under various regulations such as the Dangerous Machines (Training of Young Persons) Order 1954, the Prescribed Dangerous Machines Order 1964 and the Woodworking Machinery Regulations 1922.

The protection and guarding of machines and machine tools are regulated by the Factories Act and the Offices, Shops and Railway Premises Act in those parts of Corporation premises which officially come within these Acts. Even if the area is not recognised as a factory or office area within the Acts, any machines and machine tools should nevertheless be guarded and protected to 'Factories Act' standards. A practical guide to these standards can be found in the Safety, Health and Welfare booklets published by H.M. Stationery Office; also, the Centre of Industrial Health and Safety at 97, Horseferry Road, Victoria, London, S.W.1, shows many examples of good safety practices.

Heads of Departments and Engineers-in-Charge responsible for premises classified as Engineering Premises should, so far as the Factories Acts apply to the premises, seek advice, when needed, from the local Factory Inspector and inform the appropriate Superintendent Engineer if agreement is not reached within the framework of BBC practice.

3.4.3 Tape Recorders (see Regulation 2.3.5)

If the mechanical parts of tape recorders are touched when they are in motion, the danger of injury is greatest when the tape is being re-wound at high speed, particularly in video tape recorders where the moving parts are much more massive, or in the associated rewinding machines. Great care should be exercised when cleaning the Video Head Assembly of a Video Tape Recorder and only methods approved by H.E.Tel.Rec. should be used.

3.4.4 Lifting Gear (see Regulations under 2.3.12)

It is the responsibility of each Engineer-in-Charge or Head of Department, as appropriate, to ensure that all lifting gear under his control is safe to use.

3.4.5 Fluorescent Tubes

Beryllium compounds are no longer used in fluorescent tubes and the danger from this cause is therefore removed. When, however, local authorities make special arrangements for the collection and disposal of expended lamps and fluorescent tubes, these facilities should be used. When local dispersal is necessary, goggles and gloves should be worn as protection against flying glass.

3.4.6 Polytetrafluoroethylene (P.T.F.E.)

This material, also known under the trade name of

'Fluon', is sometimes used as an insulating material, for example in valveholders, high-temperature capacitors and radio-frequency cables; it is white or mottled grey in colour and has a smooth waxy feel resembling that of candle grease. Although completely inert at normal temperatures it may give off decomposition products if overheated, e.g. by a soldering iron, and these products can produce unpleasant effects if inhaled. The fumes may arise if the material is heated above 350 degrees C.

Those who work with P.T.F.E. may be attacked by Polymer Fume Fever, especially if they roll their own cigarettes and get small particles into them.

3.4.7 Butane and Propane Gas

Butane and propane are both heavier than air, and can therefore lie in hollow places such as pits or sumps, forming an explosive mixture.

3.4.8 Carbon-tetrachloride (C.T.C).

Inhibisol is recommended as a cleaning agent to replace C.T.C. It is readily available and equally effective, and it is safer, though it must be used with good ventilation.

3.4.9 Lifting and Carrying

Wrong methods of lifting and handling are liable to result in rupture or spinal damage, and staff who have to handle heavy objects should learn the correct methods of taking various types of strain.

Even when the correct methods are used the handling of excessively heavy objects unaided may result in permanent damage to the spine.

3.4.10 Spray Painting (see Regulations under 2.3.23)

Nearly all paints used in spraying contain solvents and thinners that are either flammable or injurious to health. The spraying process, by converting the paint into a cloud of fine droplets mixed with air, can produce a very explosive mixture. The Regulations have therefore been framed with these three dangers in mind.

It is important that only the amount of paint and thinners required for one job should be brought into the spraying room at one time, and it should not be forgotten that clothing contaminated with paint or solvents may remain highly flammable and should therefore be changed as soon as possible after completion of the job.

Any attempt to destroy an aerosol container, especially by puncturing or by fire, entails the risk of explosion.

3.4.11 Hand Tools

It is important that all hand tools be maintained in good condition. Accidents can easily be caused by worn file handles, spanners and screwdrivers and by mushroomed chisels and loose hammer heads. (Regulation 2.3.27.)

3.5 Electrical Hazards: General

3.5.1 Work on Live Equipment

(a) Remember that danger may arise not only from d.c. or a.c. voltages but also from signal or r.f. voltage carried by or induced in conductors. (Regulations under 2.4.1.)

(b) In accordance with the spirit of Regulations 1.1 and 1.3 the Senior Engineer or Technician on Duty will ensure that all reasonable precautions are taken. (Regulation 2.4.1(e).)

Points he would do well to bear in mind are:

- (i) To see that only the correctly rated insulated test prods are used on live circuits.
- (ii) That it is of the utmost importance that insulated test prods are correctly assembled before use, and that they must be used with great care.
- (iii) To ensure that the greatest care is exercised when tools are used on live equipment. Such tools must have efficient insulating handles and must not be used in such a way as to create the risk of a short-circuit that might have dangerous results.
- (iv) To see that pencils are never used to operate a contactor or to point out possible faults; the graphite core is a conductor.
- (v) To see that ample illumination is provided.
- (vi) To urge upon those working under him the desirability of removing metallic personal accessories, such as rings, bracelets or metallic watch-bands and as far as possible to use only one hand in performing the work, the other being kept clear.

(c) The Regulation about permission being obtained from the senior engineer on duty to over-ride an interlock applies even though restoration of a programme after a breakdown could be expedited by ignoring it. (Regulation 2.4.1(c).)

3.5.2 Operation of Electricity Supply Authority's Switchgear

Warning: Incorrect operation of switchgear associated with the mains may cause considerable damage and in certain circumstances may produce conditions on the supply system that may endanger the lives of the Electricity Supply Authority's employees. (Regulation 2.4.5).

3.5.3 Fusing and Earthing

The objects of the Regulations under 2.4.6 are:

(a) to ensure that the supply is interrupted if a short-circuit occurs between the line and neutral conductors, which might endanger personnel and equipment;

(b) to ensure that the supply is interrupted if accidental contact occurs between live conductors and the external metalwork of the equipment, which might cause such metalwork to be at a dangerous voltage above earth;

(c) to avoid the risk that exposed metalwork might acquire a dangerous voltage above earth by the accumulation of static charges, or by accidental contact with live conductors external to the equipment.

Requirements (a) and (b) will both be satisfied if there is a suitable fuse in the line conductor and a connection between the exposed metalwork and the neutral conductor, provided that the total resistance in the path of the fault current is sufficiently low to pass enough current to blow the fuse. With a mains supply, the supply authority should provide an earth connection to which the neutral is connected at a point chosen by them. With a supply from a local generator, e.g. a mobile generating plant, the earth connection should be made, at the generator, to the neutral terminal of the supply, which must be bonded to the vehicle chassis; to satisfy requirements (a) and (b) this point need not be connected to an earth electrode, but to satisfy requirement (c) an actual connection to earth is necessary, and the resistance between the exposed metalwork and the mass of the earth must be sufficiently low to ensure that a person standing on the ground or floor or in contact with any other metalwork in the vicinity cannot be exposed to a dangerous voltage.

These arrangements will not provide sufficient protection in cases where the fault current is insufficient to blow the fuse but is yet large enough to create a dangerous voltage between the exposed metalwork and earth. This may occur if the current consumption of the equipment is so great that a fuse of high rupturing capacity must be used or if the resistance between the exposed metalwork and the neutral of the supply is too high. In such cases additional protection is necessary, such as an earth leakage protection system.

Double-pole fusing is not permitted because of the danger that the fuse in the neutral conductor might blow leaving the fuse in the line conductor intact and metalwork in contact with it live.

Though proper earthing is vitally important, an unexpected earth or an earth in the wrong place can also be dangerous, and care must be taken that this does not occur. An example of an unexpected earth would be a receiver aerial touching a tree.

3.5.4 Portable Equipment and other Electrical Appliances (see Regulations under 2.4.7)

(a) The term Electrical Appliances includes desk lamps and hand lamps.

(b) The expression flexible lead in these Regulations means a flexible cable or cord, covered with tough rubber or an equivalent grade of insulation, and using multi-strand fine-wire conductors as specified in the tables of Flexible Cables and Flexible Cords in the current edition of the I.E.E. Regulations for the Electrical Equipment of Buildings.

(c) The colour coding of the line, neutral and earth conductors should be indicated on the appliance. If it is not, care must be taken to ensure that the earth conductor is correctly identified, because the colour coding is not internationally standardized.

(d) The Engineer-in-Charge is not responsible, except with his express agreement, for maintaining any appliance belonging to any non-Engineering Department.

(e) When doubt arises about the state of the insulation of flexible leads (Regulation 2.4.7(b)), those with a tough rubber or plastic sheath may be tested by immersing all but a foot at each end in weak brine and applying a Megger between the brine and each conductor. If the tests are satisfactory, the two ends which have not been tested should be cut off and the connections remade.

(f) It is preferable that electric heaters of the radiant type should, if possible, be mounted at a safe height on walls (Regulation 2.4.7(k)).

3.5.5 *Storage-battery Rooms* (see Regulations under 2.4.9)

(a) The gases given off by storage batteries when charging are not only highly explosive but may be injurious if inhaled in quantity (Regulations 2.4.9(a), (b) and (c)).

(b) Particular care should be exercised to avoid contact with battery terminals or conductors, especially when it is necessary to introduce movable metal objects into battery rooms, e.g. lengths of wire or piping.

(c) Remember that at one end of a storage battery the full voltage may exist between the connecting bars and earth (Regulation 2.4.9(d)).

3.5.6 *Testing of Sound and Television Receivers and similar equipment when the Corporation is responsible: General* (see Regulations under 2.4.11)

Where the responsibility for the maintenance of a receiver has been delegated to a dealer, the Head of Department, Regional Head of Engineering or Engineer-in-Charge responsible for placing the order should satisfy himself as far as practicable that the dealer is a reliable person who can be trusted to restore the receiver to a safe condition after maintenance work has been done on it. It is usually desirable that the dealer should be the local agent for the manufacturer of the receiver concerned. (Regulation 2.4.11(a).)

3.5.7 *Radio-frequency and X-radiation* (see Regulations 2.4.14 and 2.4.20)

Warning: Staff are warned that injury can arise from exposure to intense electromagnetic radiation because of the heating effect in human tissue produced by dielectric and other losses, or because of physiological changes produced by X-radiation.

It is the responsibility of the Engineer-in-Charge to inform himself of any conditions of operation in which the prescribed limit of radiation intensity for long-term continuous exposure might be exceeded in any areas where equipment for which he is responsible is in operation or undergoing test. In any case of doubt he should refer to the Head of his Department or Superintendent Engineer who will seek the advice of Research Department as necessary.

3.5.8 Covers of Apparatus (see Regulation 2.4.15(c))

If equipment must be operated in rain or damp conditions, ventilated protection should be provided wherever possible. It is clearly important to keep junction boxes and cable connectors out of puddles, and care must be taken in placing cables and equipment so that they are not liable to damage from accumulations of water.

3.5.9 Tidy Working

All electrical work should be carried out in a neat and workmanlike manner; careless or untidy work may result in danger from electric shock. Examples of such careless work are:

loose terminals

loose clippings of wire in switch-boxes etc.

earth sockets on three-pin sockets not properly earthed

stranded conductors partially severed

loose strands of wire projecting from terminals or screw connectors.

Untidy electrical work may also give rise to fire (see Section 3.2.11).

3.6 Power Distribution Circuits, Wiring and Switchgear

3.6.1 General

Insulating oil as used in power transformers, power-factor correction capacitors, oil-filled switchgear, motor starters and the like can produce highly-explosive vapours when subjected to fault conditions. These vapours can be readily ignited by a spark or naked flame; consequently all enclosures must be thoroughly ventilated before maintenance work is started, or when such devices are opened up after a failure.

3.6.2 Isolation of Sections of Distribution Systems

An attempt to close a manually operated isolator on a live circuit of high short-circuit capacity would result in grave risk of injury if certain faults existed on the circuit controlled by the isolator. (Regulation 2.5.2(b).)

3.6.3 Work on High-voltage Switchgear

An attempt to close a solenoid-operated breaker manually on to a live circuit of high short-circuit capacity would result in grave risk of injury if certain faults existed on the circuit controlled by the breaker. (Regulation 2.5.5(e).)

3.6.4 Work on Power Transformers

Isolated but unearthed windings of high-voltage transformers may hold a static charge capable of causing severe electric shock. (Regulation 2.5.6(b).)

3.6.5 Work on Power Cables

Any attempt to earth a conductor which has not been isolated may result in grave risk of injury; a conductor that has been isolated but not earthed may be dangerously charged. (Regulations 2.5.7(a) and (b).)

3.7 Studio, Film and Outside Broadcast Equipment

Warning: Television equipment nearly always contains circuits operating at high or extra-high voltages. Voltages of the order of 700 are common in the power supply units and voltages of up to 25 kV may be encountered in circuits associated with cathode-ray tubes.

3.7.1 Studio Grid Areas

(a) At certain stations riggers are not available for suspending equipment, and at these stations such work has to be carried out by Technical Operations staff. (Regulation 2.6.1(a).)

(b) Lightweight zip-up jackets and trousers, secured by elastic at waist, wrist and ankles, are available to Technical Operations staff needing pocketless clothing for entering the grid. They should apply to the studio engineer. (Regulation 2.6.1(c).)

(c) Technical Managers or Sound Supervisors should discourage the use of equipment suspended directly from above the grid; use should normally be made of spare lighting or scenic hoists or the lighting galleries, in accordance with traditional practice. (Regulation 2.6.1(d).)

3.7.2 Production Lighting Equipment

(a) Regulation 2.6.2(f) cannot at present be applied at Television Film Studios at Ealing where the luminaires operate on 100 volts and have two-pin plugs. Special care must therefore be taken in handling these luminaires, the adjacent metalwork and associated Kliegl boxes.

(b) Removal of a luminaire may be necessary to ensure thorough cleaning and elimination of glass particles after an explosion. (Regulation 2.6.2(j).)

(c) Compact-source discharge lamps can be dangerous in two ways:

(i) The source generates a strong ultra-violet component which can cause eye-strain and burns.

(ii) The lamps operate at very high internal pressure and may explode violently.

The lenses supplied with such units are designed for protection against personal injury. They filter out the ultra-violet radiation and provide physical protection in the event of explosion.

3.7.3 Film Equipment and Film Handling

Part 4 of the General Safety Regulations issued by Staff Administration for Non-Engineering Staff handling Television or Film Equipment should also be consulted. (See Regulations under 2.6.3.)

3.7.4 Studio Effects (Regulations 2.6.5(a) and (c).)

The operating supply for electrically operated studio effects should be fed through a low-voltage or isolating transformer, or if this is not practicable and where the installation can be suitably earthed, may be taken direct from single- or three-phase mains. If, however, battery-operated effects can be used, this is to be preferred since, after installation, these may be operated by non-engineering staff.

Where battery-operated effects are used, the Regulations applicable to the voltage classification of the battery must be observed.

Where compressed air is used the precautions laid down in Regulation 2.3.11 must be observed.

3.7.5 Broadcasts from Places to which the Public is admitted

(a) All staff concerned with broadcasts from places where the public is present should bear in mind the risks which might arise from excitement or even panic amongst members of the public, engendered by the events at an O.B. They should also reckon with an increased pressure of the public against ropes and barriers at the close of a performance or even on account of a sudden shower of rain.

(b) Cameramen are exposed to special risks, both because their attention is so much focused on the scene and because they may be operating in exposed positions on scaffolding etc. The rest of the camera crew must therefore be continually alert that cameramen do not come into collision with scenery or luminaires.
(See Regulations under 2.6.6.)

3.7.6 Camera and Microphone Mechanical Mountings

Attention is called to the importance of securely earthing motor-operated camera cranes and of guarding against over-running and nipping the cables. (See Regulations under 2.6.8.)

3.7.7 Scaffold-tube Platforms (see Regulation 2.6.9(a)(vi))

The object of this Regulation is to prevent any member of the audience or the public from obtaining access to the area underneath the platform and to obviate the risk of anyone damaging himself by coming into contact with the scaffold-tubing or the scaffold-tube clamps.

3.7.8 Picture Monitors and Receivers (see Regulations under 2.6.10)

(a) There is a possibility of implosion of cathode-ray tubes and great care should be taken in handling them; even a slight scratch may weaken the envelope and cause an implosion. The danger is the greater the larger the tube, and is greatest when several tubes are close together so that the implosion of one can damage others. Staff whose work necessitates the handling of cathode-ray tubes must wear splinter-proof goggles and gloves.

(b) There is some radiation of X-rays from cathode-ray tubes. With direct-viewing tubes there is no danger under normal viewing conditions, but prolonged exposure at close quarters to the radiation from projection tubes should be avoided.

3.8 Transmitting Stations: Special Electrical Hazards

3.8.1 Motor-generators

The large motor-generators which are installed at certain stations to provide the main high-voltage supply for transmitters are capable of rotating for a considerable time after the supplies to the motors have been switched off. Because of residual magnetism the generators produce dangerous output voltages until they have come to rest.

3.8.2 Plant Enclosures and Cubicles (see Regulations under 2.7.2)

(a) The auxiliary circuits can be made dead by means of a separate non-interlocked isolator which is situated in a conspicuous position. Where the apparatus is included in a red/green safety lamp system, coloured lamps controlled by the isolator indicate whether the auxiliary circuits are live or dead. These lamps are mounted in conspicuous positions so as to be visible from inside and outside the enclosures. The red lamp indicates that the auxiliary circuits are live; the green lamp indicates that they are dead.

Warning: A lamp failure may mean that no light glows, and a red light condition must, therefore, be assumed until the fault has been cleared.

(b) The references to auxiliary circuits above include control and interlock circuits but do not include lighting or lamp indicator circuits, which may still be live when both the main and auxiliary equipments have been made dead.

3.8.3 Smoothing Circuits (see Regulations under 2.7.6)

The capacitors of smoothing circuits will hold or build up a charge unless the high-voltage connection is solidly earthed. In transmitters employing cathode followers a negative voltage is applied between the cathode-follower cathodes and earth. If the filament of a cathode follower is energized, an electric path exists between cathode and anode, and if grid bias is applied the anode smoothing may be charged to the bias potential. In certain installations this bias potential is dangerously high.

3.8.4 High-voltage Mica, Paper and Oil-filled Capacitors (see Regulations under 2.7.7)

Some capacitors retain a charge after the removal of power supplies to the equipment containing them, and can therefore be dangerous.

Certain high-voltage smoothing systems are fitted with surge-limiting resistors in the negative leads from the capacitors. If a resistor becomes burnt out or otherwise open-circuited, the associated capacitor will be unsafe to handle until both positive and negative terminals have been earthed and subsequently short-circuited.

3.8.5 Earthing Wands (see Regulation 2.7.8(a))

It is emphasized that the prohibition of the use of earthing wands is vitally important in relation to high-voltage a.c. power-supply circuits. On such a circuit they must never be used in any circumstances whatever, because in the event of the circuit being live the person using the earthing wand would in all probability sustain fatal injury.

3.8.6 Handling of Klystrons (see Regulations under 2.7.10)

Certain high-power klystrons used in UHF transmitters and semiconductor devices, mainly in VHF/UHF equipment, contain beryllium compounds in the ceramics; when in powder form these compounds are harmful if inhaled or absorbed into the body through a break in the skin.

3.9 Masts, Aerials and Aerial Feeders

3.9.1 Masts

(a) It is the responsibility of the Senior Maintenance Engineer to see that the duration of the permit to ascend a mast is not exceeded. Where the duration exceeds one hour and a person is on the mast by himself, it is likewise the responsibility of the Senior Maintenance Engineer to check at reasonably frequent intervals (at least every half-hour), taking into account the nature of the work and the prevailing weather conditions, that all is well. This he will do either by observation or, if the facility is available, by telephone. (Regulation 2.8.1(b).)

(b) The Engineer-in-Charge or his deputy, or the Senior Specialist Engineer on Duty will not give permission for the ascent of a mast unless he is satisfied that the weather throughout the period will not introduce undue risk. Factors affecting this decision are:

- (i) *High Wind.* A high wind at the top of the mast is dangerous.
- (ii) *Rain.* Heavy rain makes the operation hazardous.
- (iii) *Air Temperature.* A temperature as low as 32°F and falling makes ice formation likely.
- (iv) *Ice.* The presence of ice on the mast introduces undue risk.

3.9.2 Aerials and Aerial Feeders

Warning: Although radio-frequency currents do not cause electric shock they can cause burns. Serious injury of this kind may result from contact with conductors carrying radio-frequency currents in high-power transmitting installations. In consequence, the carrying of metal ladders, piping etc. under energized open-wire

feeders, or the handling of any metal objects in a strong r.f. field, can be dangerous.

Regulation 2.8.3(b) is a precaution to prevent injuries from burns due to handling conductors in which voltages are induced from neighbouring energized systems, and it is emphasized that an earth connection may be ineffective at radio frequencies as a protection against burns unless its length is very short compared with the wave length.

3.9.3 Short-wave Aerials and Aerial Arrays

If local conditions make compliance with Regulation 2.8.4(d) impracticable, the senior engineer on duty is responsible for keeping the interlock key in safe custody until the work on the array or feeder has been completed and it is safe to apply power.

3.9.4 VHF and UHF Aerials at Transmitting Stations

In the context of Regulation 2.8.7(e), 'supervision' means technical supervision and not necessarily visual supervision. The responsible engineer must not send a member of manual staff aloft unless he is satisfied that the man is certain of the work to be carried out and appreciates possible hazards.

APPENDIX A

PERMIT-TO-WORK FORM

(*See Regulation 2.5.10*)

The Permit-to-Work Form referred to in Regulation 2.5.10 will take the form shown below:

THE BRITISH BROADCASTING CORPORATION

PERMIT TO WORK

---

*1. ISSUE

Issued to
Work to be carried out
I hereby declare that the following equipment is dead, isolated from the supply and connected with earth.

Note: No work on any other equipment must be carried out until a further permit is issued.

Equipment isolated at
locks fitted at
earthed at
warning notices posted at
special precautions to be taken

Time Date Signed

---

* See page A.2.

2. RECEIPT

I hereby declare that I accept responsibility for carrying out the work on the equipment detailed in 1 above, and no attempt will be made by me or by men under my control to carry out work on any other equipment.

Time	Date	Signed †Post

3. CLEARANCE CERTIFICATE

I hereby declare that the work for which this permit was issued is now suspended/completed and that all men under my charge have been withdrawn and warned that it is no longer safe to work on the equipment detailed in 1 above, and that all gear, tools, temporary earthing connections, have been removed, and that all screens, partitions etc. have been replaced.

Time	Date	Signed

*4. CANCELLATION

All earths, locks and warning notices referred to in 1 above have been withdrawn and this Permit-to-Work is hereby cancelled.

Time	Date	Signed

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* Parts 1 and 4 must be signed by a member of the BBC Engineering Division authorized to issue Permits-to-Work for the equipment.

† Where this permit is issued to the Contractor's Representative or any person other than a BBC employee the name of the Firm or Board must be stated here.

The procedure for the use of the Permit-to-Work Form is as follows:

(a) The work may not begin until the ISSUE section of the form has been completed and signed by the senior engineer on duty, and the RECEIPT section has been completed and signed by the senior member of the staff who are to carry out the work.

(b) The ISSUE section of the form must contain particulars of

- (i) the work to be carried out,
- (ii) the extent of the circuits which have been made dead,
- (iii) the points at which the equipment has been isolated, earthed and locked, and where warning notices have been posted and
- (iv) special precautions to be taken.

(c) The ISSUE section is to be completed and signed in duplicate. One copy of the form is to be handed to the person to whom the permit is issued and the other, after the RECEIPT section has been completed, must be posted up in the prescribed place so that it shall be obvious to all operating staff concerned that such a permit is in existence.

(d) The person to whom the form is issued must not take the permit away from the site of the work while the work is in progress. In the event of his leaving the site and handing over responsibility to another person, the Permit-to-Work Form must be suitably amended by the issuing official, who must initial the amendments; the form must then be handed to the person to whom the responsibility is transferred.

(e) Upon completion of the work, the responsible person holding the permit must sign the CLEARANCE CERTIFICATE section of the form and return the latter to the senior engineer on duty. The senior engineer on duty must then satisfy himself that it is safe to re-power the equipment upon which the work has been carried out. It is his responsibility to ensure that the circuits are restored to normal and that the warning notices are withdrawn. Finally, the senior engineer on duty will sign the CANCELLATION section of the form, withdraw the duplicate of the ISSUE section which has been posted up and pass both copies of the form to the Engineer-in-Charge for filing.

(f) In the event of the work for which the permit has been issued having to be temporarily suspended, the procedure is the same as for completion of the work except that the CLEARANCE CERTIFICATE will refer to suspension and not to completion of the work. Before the work is re-started a new Permit-to-Work Form must be issued.

APPENDIX B

CERTIFICATES OF AUTHORIZATION

(*See Regulation 2.4.1*)

The Certificate referred to in Regulation 2.4.1(e) (i) will take the form shown below:

THE BRITISH BROADCASTING CORPORATION

CERTIFICATE OF AUTHORIZATION

PART 1

This is to certify that Mr. .... (Staff No. ....) is authorized to work on electrical equipment and wiring while live conductors are exposed provided that BBC Safety Regulations for Engineering Staff and any relevant local instructions are observed.

I am satisfied that he appreciates the risks involved in carrying out such work on electrical apparatus generally and I believe that he is a person likely to bear such risks constantly in mind and to appreciate the importance of behaving at all times in such a way as not to endanger his own safety or that of others.

Signed ....

Designation ....

Date ....

PART 2

I understand that I am authorized by the BBC to work on electrical equipment or wiring with live conductors exposed, so far as may be necessary in the course of my work. I appreciate the risks involved in such work and the importance of observing the BBC Safety Regulations for Engineering Staff and any relevant local instructions.

I also appreciate the importance of behaving at all times in such a way as not to endanger myself or any other person. I undertake to consult the person under whose direction I am working before carrying out work on any apparatus with which I am unfamiliar, so as to ensure that I understand any risks that may be involved in carrying out such work.

I understand that the Certificate that has been issued to me may be withdrawn in the event of my not complying with the BBC Safety Regulations for Engineering Staff or failing to exercise due care in carrying out the work entrusted to me.

Signed ....

Staff No. ....

Date ....

APPENDIX C

PUBLICATIONS ON SAFETY

C.1	*Occupational Safety Bulletin*,	published monthly by the Royal Society for the Prevention of Accidents.
C.2	*Industrial Safety*,	published monthly by United Trade Press Ltd.
C.3	*Accidents*,	published by the Ministry of Labour, H.M. Factory Inspectorate, quarterly.
C.4	*Manual Lifting and Handling: Human Kinetics for the Industrial Worker*,	by T. McClurg Anderson, published by the Industrial Welfare Society.
C.5	*British Journal of Occupational Safety*,	published quarterly by the Royal Society for the Prevention of Accidents.
C.6	*Annual Report of the Chief Inspector of Factories*,	from H.M. Stationery Office.
C.7	*Annual Report of the Chief Inspector of Factories on Industrial Health*,	from H.M. Stationery Office.

A number of publications on particular aspects of safety are available from H.M. Stationery Office.

SAFETY REGULATIONS

Remove the 7th edition of *Safety Regulations for Engineering Staff* from your red loose-leaf binder and insert the 8th edition attached. Be careful not to remove the *General Safety Regulations* which are also in your binder but are printed in a different type.